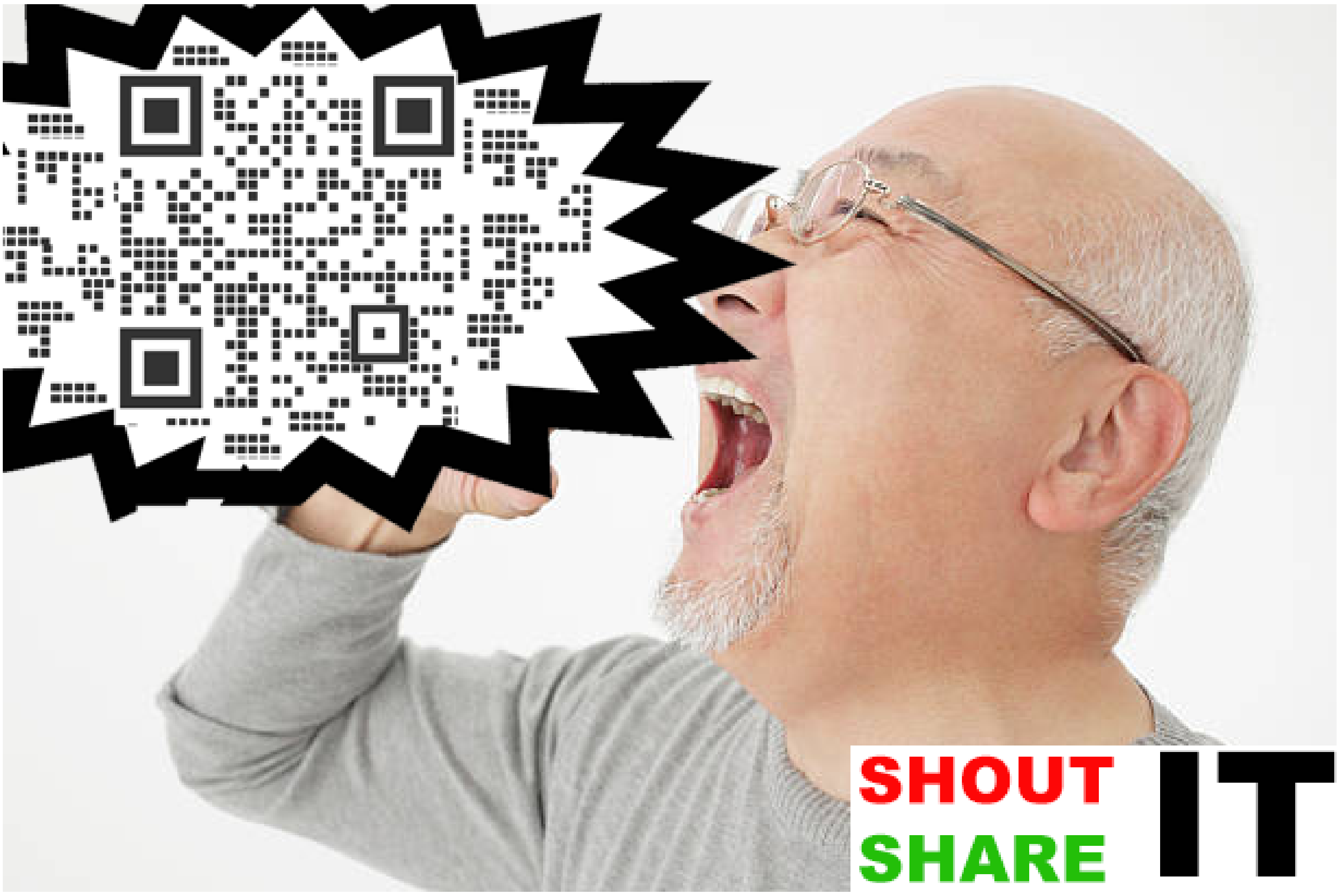
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Miſs Anna E. Henry

Pittsfield

Maſs.

June 24th 1874.

Senior Class.

THE

BOOK OF NATURE.

BY

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PREFACE.

The present volume, which is designed to take a systematic, but popular, survey of the most interesting features of the general SCIENCE OF NATURE, for the purpose of elucidating what has been found obscure, controverting and correcting what has been felt erroneous, and developing, by new and original views and hypotheses, much of what yet remains to be more satisfactorily explained, derives its origin from the following circumstances:

Towards the close of the year 1810 the author had the honour of receiving a visit from a deputation of the Directors of the SURREY INSTITUTION, founded on what had been antecedently the LEVERIAN MUSEUM, with a request on the part of their chairman, Dr. Adam Clarke, that he would undertake a department of lectures in that literary and scientific establishment; with the generous offer of leaving to himself a nomination of time, terms, and subject. He regretted his inability of acceding to so kind a request at that particular period; but being a little more at liberty not long afterwards, he readily consented, on a second application by Dr. Lettsom and other Directors; and the ensuing volume contains the course of study he ventured to make choice of; the lectures having been divided into series, and delivered in successive years.

It was his intention to have carried the plan to a somewhat more protracted extent, though the present is sufficiently complete for the outline laid down: but, though earnestly and repeatedly pressed to proceed further, or even to go over the same lectures again, an augmented sphere of professional duties compelled him, with much reluctance, to decline the invitation; and the same cause has prevented him, till the present period, from fulfilling a subsequent request to submit them to the public; though he has always intended to do so as soon as he could find leisure.

As the lectures were delivered from general recollection, though with the author's manuscript at hand, it is possible that those who took notes may find a few passages in the present text slightly varied from what was uttered at the time. Yet he believes that, upon an accurate examination, such discrepancies will be found but few, and of no importance.

The INSTITUTION has had its day, but it set in glory, and had the satisfaction of reaping its own reward. Its proprietary shares, like those of every other literary institution in this metropolis, were soon found to have been fixed at too low a price. And, a difficulty having been experienced in obtaining the consent of every proprietor to an adequate additional subscription, it was wisely resolved, almost from the first, to make a yearly encroachment upon the capital, and to maintain the Institution at its zenith of vigour and activity till the whole of such capital should be expended, rather than to let it live through a feeble and inefficient existence, though for a longer period of time, by limiting it to the narrow scale of its annual income alone.

To the crowded and persevering audience by which, from year to year, the author had the gratification of being surrounded, many of whom are yet within the circle of his acquaintance and friendship, he still looks back with gratitude; and can never forget the ardour and punctuality of their attendance. It is a lively recollection, indeed, of the manner in which his labours were received, when delivered, that chiefly induces him to hope for a favourable reception of them in their present form.

The progress of time, and the mental activity with which it has been followed up, have strikingly confirmed various hints and opinions which he ventured to suggest as he proceeded, and have introduced a few novelties into one or two branches of science since the period referred to; but the interval which has hereby occurred has enabled the author to keep pace with the general march of the day, and to pay due attention to such doctrines or discoveries in their respective positions of time and place.

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THE

BOOK OF NATURE.

SERIES I.

LECTURE I.

ON MATTER, AND A MATERIAL WORLD.

IN the comprehensive range of science proposed to be treated of in the SURREY INSTITUTION, the department to which I shall have the honour of beseeching your attention will be that of NATURAL PHILOSOPHY, OR PHYSICS, in the most extensive sense of these terms: that branch of science which makes use of the individual principles and discoveries of every other branch within the range of nature, as the architect makes use of the bricks, the mortar, the wood, and the marble of different artizans, and builds up the whole into a perfect edifice; which takes a bird's-eye view, as it were, of a picturesque and spreading landscape from some commanding eminence; and, without having laboured in the details of arranging the ground, of cultivating the soil, of planting the woods, of winding the rivers, of enriching the scenery with flocks, herds, bridges, and buildings, points out the general connexion of part with part, and the harmony which flows from their combined effect. This, indeed, is to employ these terms in a somewhat wider sense than has been assigned to them in modern times; for even the Natural Philosophy of Lord Bacon, though it embraces the two divisions of special physic and metaphysic, as he calls them, does not extend to the doctrine of "the nature and state of man," which is transferred to another division of general science;* yet that the study of physics, or natural philosophy, had this more extended meaning among the Greeks and Romans, is clear, since the poem of Empedocles on "Nature," and that of Lucretius, on "the Nature of Things," the two most complete physiological works of which we have any account in antiquity, were expressly formed upon this comprehensive scale; and hence the philosophy of geology and mineralogy, the philosophy of botany and zoology, the philosophy of human understanding, the philosophy of society and whatever relates to it, or general and synthetical surveys of these different departments of science, are as equally branches of physics, or the nature of things, as equally part of the BOOK OF NATURE, as any separate branch which is more ordinarily so arranged.

Thus explained, the scope of the study before us is almost universal, and only a small portion of it can be engaged in during a single series. I shall endeavour to advance in it as I am able; and the infinite variety it presents to us will at all times, I trust, prevent the pursuit from proving dull or uninteresting. Could it indeed be completed as it ought, it would constitute the PHILOSOPHIA PRIMA, or universal science of the great author I have just adverted to.

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* Advancement of Learning, b. ii. p. 52. 56. vol. i. 4to. General science is here divided into three classes: I. Doctrina de numine, or Divine Philosophy. II. Doctrina de natura, or Natural Philosophy. III. Doctrina de homine, or Human Philosophy. The common stem from which they ramify is denominated philosophia prima, primitive, summary, or universal philosophy.

My sole object, however, is to communicate information so far as I may be able; to exhaust nothing, but to touch upon many things; to give a desire for learning, rather than to consummate the learning that may be desirable; to run over the vast volume of nature, not in its separate pages, but in its table of contents, so that we may hereafter be the better prepared for studying it more minutely, and for feeling in some measure at home upon the various subjects it presents to us.

Yet, after all, lectures alone can do but little, whatever the energy or perspicuity with which they may be delivered. They may, perhaps, awaken a latent propensity, or enkindle a transient inclination; but unless the new-born flame be fed and fostered, unless it be nourished by study, as well as excited by hearing, it will perish as soon as lighted up; or, if it continue, will only blaze forth in a foppery of knowledge far more contemptible than the grossest ignorance.

Let us then enter upon our respective duties with equal ardour. The path of science is open to every variety of age, and almost to every variety of education. Thousands at this moment behind are pressing forward, and will surpass those that are before; and the richest and most gratifying reward I can ever receive will be, to find that many to whom this course of study is delivered will hereafter be able to communicate to me the same proportion of information, which it is my duty to suppose I can at present communicate to them.

One of the first inquiries that can ever press upon the mind must relate to the nature of MATTER, and the origin of the world around us: what is this common substance from which every thing visible has proceeded, and to which every thing visible is reducible? has it existed from all eternity? or has it been called into being by the voice of an Omnipotent Creator? and in either case, has it uniformly exhibited its present harmony and arrangement, or has there been a period in which it was destitute of form and order, a waste and shapeless chaos?

These are questions which have tried the wisdom of man in all ages; and, I may add, which in all ages have proved its littleness, and the need we stand in of illumination from a superior source. Such, upon one or two points, we have received; upon the rest we are still ignorant; and, but for what we have received, we should have been still ignorant upon the whole.

If we search into the systems of all the ancient schools of philosophy, amidst an infinite variety of jarring opinions in other respects, we find them, perhaps without an exception, concurring in a belief of the eternity of matter, or that general substance which constitutes the visible world around us; which was sometimes conceived to be intelligent in many of its corpuscles, and unintelligent in the rest, as was taught by Democritus; sometimes intelligent as a whole, though unintelligent in its separate parts, as taught both by Aristotle and Plato; and sometimes unintelligent in all its parts and particles, whether united or disjoined, which formed the dogma of Epicurus. Under some modification or other, however, the doctrine of the eternity of matter appears to have been universal

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among the philosophers of ancient nations. That a loose and floating idea of its creation by the energy of a pure intelligence is occasionally to be met with, and which probably existed as a remnant of patriarchal tradition, must be admitted; for the Tuscans were generally allowed to have entertained such an idea, and we find it frequently adverted to and opposed by the leaders of the different schools, but in no instance does it seem to have been embodied or promulgated as a doctrine of philosophy.

The grand motive for this general belief appears to have been a supposed absurdity in conceiving that any thing could be created out of nothing.* The Epicureans, and many other schools of philosophers, who borrowed it from them, perpetually appeal to this position. It was current, however, among many of the philosophers of Greece at a much earlier period; for Democritus expressly asserted, according to Diogenes Laertius, "that nothing could spring from nothing, or could ever return to nothing." Epicurus, in the few fragments of his that have reached us, echoed the tenet in the following terms: "Know first of all, that nothing can spring from non-entity." It was thus given by Aristotle: "To suppose what has been created has been created from nothing, is to divest it of all power, for it is a dogma of those who pretend thus to think, that every thing must still possess its own nature." From the Greeks it passed to the Romans, and appears as follows in Lucretius:—

ubi viderimus nihil posse creari
De nihilo, tum, quod sequimur, jam rectius inde
Perspiciemus.†

Admit this truth, that naught from nothing springs,
And all is clear.

And it was thus long afterwards reiterated by Persius, as the common doctrine of his day:—

gigni
De nihilo nil, in nihilum nil posse reverti.‡

Naught springs from naught, and can to naught return.

The Greeks themselves, however, seem to have received it from the East, and to have become acquainted with it as a branch of gymnosophy: for it constitutes, even in the present day, a distinct doctrine of Brahminical religion, and is thus urged in univocal terms in the Yajur Veid, in the course of an address to Brahm, or the Supreme Being: "The ignorant assert that the universe, in the beginning, did not exist in its author, and that it was created out of nothing. O ye, whose hearts are pure! *how could something arise out of nothing?*"§

This reasoning seems, indeed, to have spread almost universally, and perhaps from the same quarter; for we find many of the Jewish theologians, and not a few of the Christian fathers, too much influenced by Platonic principles, giving countenance to the same doctrine, though probably not to the full extent of the Platonic school. Thus the author of the Book of Wisdom, a book written in Greek instead of in Hebrew, and hereby proving his own æra as well as the school in which he had studied, expressly asserts that " *The almighty hand* of the Lord created the world out of *unfashioned* (amorphous) *matter*," εξ αμορφȣ ὑλης ;* while Athenagoras, Tatian, Theophilus of Antioch, Athanasius, and Gregory Nazianzen appear to have concurred in the same opinion ; and Justin Martyr affirms it to have been the general creed of his own æra : " For that the word of God," says he "*formed the world out of unfashioned matter*, Moses distinctly asserts, Plato and his adherents maintain, and ourselves have been taught to believe."

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* This, and two or three subsequent passages in the present lecture, are given summarily from an ampler and more recondite view of the subject in the author's prolegomena to his translation of "THE NATURE OF THINGS."

† De Rer. Nat. i. 157.

‡ Sat. iii. 83.

§ The passage is quoted from M. Anquetil De Perron's Latin version. The reader may find various similar extracts in Sir William Jones's works, vol. vi. 4to. edit.

This is one specimen of the very common attempt in the writings of the fathers, to blend the narrative and doctrines of Moses with the principles of Platonism, which, in truth, had been embraced by many of them before their conversion. The text of Moses, when accurately examined, will be found, if I mistake not, to lead us to a very different conclusion. This text consists of the first and second verses of the book of Genesis, and is as follows : " In the beginning God created the heaven and the earth ; and the earth was without form and void, and darkness was upon the face of the deep (or abyss) ; and the Spirit of God moved upon the face of the waters." Now in this passage we seem to have a statement of three distinct facts, each following the other in a regular series : first, an absolute creation of the heaven and the earth, which, we are expressly told, took place foremost, or in the beginning ; next, the condition of the earth when it was thus primarily created, being amorphous and waste, or, in the words before us, " without form and void ;" and, thirdly, the earliest creative effort to reduce it from this shapeless and void or waste condition into a state of order and productiveness—" the Spirit of God moved upon the face of the waters." And hence, to maintain from the Mosaic narration that the heaven or the earth existed in a waste and amorphous mass antecedently to the first act of creation, is to derange the series of such narration, and to put that process first which Moses has put second.

I enter not here into the correctness of the general rendering, nor into the exact import of the word ברא, " created ;" for whatever be the rendering, the same consecutive order of events must be adhered to, and the same conclusion must follow. I am perfectly ready, however, to admit that ברא does by no means at all times import an absolute creation out of nothing, but, like *create* in our own language, that it occasionally denotes the formation of one thing out of another ; yet when we are told that, if Moses had really intended to express an absolute creation of the earth out of nothing, he would have used some other word, which should have limited us to this idea, I confidently put it to any critic, what word he could have employed specially appropriated to such a purpose, and limited to such a sense, at the time he wrote ; or even what word, thus restrained, he could select in our own day, from any spoken language throughout the world ? Words are not invented for an exclusive expression of solitary facts, but for general use. The creation of the world, or of any thing whatever, out of nothing, is a fact of this kind ; and no language ever had or ever will have a term precisely struck out for the purpose of representing such an idea, and exclusively appropriated to it ; and assuredly there could be no such word at the time Moses first spoke of the fact, and communicated the doctrine ; as, antecedently to this, it could not have been called for.

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* Cap. xi, 17.

And it will not be questioned, I think, that there is more sound sense and judgment in employing, as on the present occasion, a well understood term, that comes nearest to the full extent of the idea intended to be conveyed, than to invent a new word for the purpose that nobody has ever heard of, and, consequently that nobody can comprehend the meaning of, till the very term that is thus objected to, or some other word from the vulgar dialect, shall be had recourse to as its interpreter. Yet although, in the Hebrew Scriptures, the word ברא is occasionally used synonymously with our own terms, "to make, produce, or cause to be," to import a formation from a substance already in existence, we have sufficient proof that it was also understood of old to import emphatically, like our own word "create," an absolute formation out of nothing. Maimonides expressly tells us, that it was thus understood in the passage before us, as well as in all others that have a reference to it, by the ancient Hebrews; while Origen affirms, that such was its import among many of the Christian fathers, whatever might be the opinion of the rest, and forcibly objects to the passage just quoted from the Book of Wisdom, as a book not admitted into the established canon of Scripture.

Still, however, the doctrine of a creation of something out of nothing was generally held to be a palpable absurdity; and a variety of hypotheses were invented to avoid it, of which the three following appear to have been the chief; each of them, however, if I mistake not, plunging us into an absurdity ten times deeper and more inextricable. The first is that of an absolute and independent eternity of matter, to which I have already referred; the second, that of its emanation from the essence of the Creator; the third, that of idealism, or the non-existence of a material world.

I have already remarked, that the FIRST of these was modified under the plastic hands of different philosophers of antiquity into a great variety of shapes; and hence, in some form or other, is to be traced through most of the Grecian schools, whether of the Ionic or Italic sect—or, in other words, whether derived from Thales or from Pythagoras. In no shape, however, is it for a moment capable of standing the test of sober inquiry. We may regard matter as essentially and eternally intelligent, or as essentially and eternally unintelligent; as essentially intelligent in its several parts, or as essentially intelligent as a whole. The dilemma is equal in all these cases. Matter cannot be intelligent as a whole, without being intelligent in every atom, for a concourse of unintelligent atoms can never produce intelligence; but if it be intelligent in every atom, then are we perpetually meeting with unintelligent compounds resulting from intelligent elements. If, again, matter be essentially eternal, but at the same time essentially unintelligent, both separately and collectively, then, an intelligent principle being traced in the world, and even in man himself, we are put into possession of two co-eternal independent principles, destitute of all relative connexion and common medium of action.

The SECOND HYPOTHESIS to which I have adverted is not less crowded with difficulties and absurdities; but it has a more imposing appearance, and has hence, in many periods and among many nations, been more popular, and was perpetually leading away a multitude of the philosophers from the preceding system. According to this hypothesis, the universe is an emanation or extension of the essence of the Creator. Now, under this belief, however modified, the Creator himself is rendered material; or, in other words, matter itself, or the visible substance of the world is rendered the Creator; and we merely shift the burden, without getting rid of it. There can be no difficulty in tracing this doctrine to its source. It runs, as I have already observed, through the whole texture of that species of materialism which constitutes the two grand religions of the East—Brahmism and Buddhism; and was undoubtedly conveyed by Pathagoras, and, perhaps, antecedently, by Orpheus (if such an individual ever existed, which Cicero* seems to have disbelieved, from a passage of Aristotle, not to be found, however, in any of his writings that have descended to us), into different parts of Greece, in consequence of their communications with the gymnosophists. From Pythagoras it descended to Plato and Xenophanes, and, under different modifications, became a tenet of the academic and eleatic schools. I have already quoted the principle on which it is founded, from M. Anquetil du Perron's translation of the Oupnek'-hat, or Abridgment of the Veids;† the passage at large is as follows, and developes the entire doctrine as well as the principle: "The whole universe is the Creator, proceeds from the Creator, exists in him, and returns to him. The ignorant assert that the universe, in the beginning, did not exist in its Author, and that it was created out of nothing. O ye, whose hearts are pure! how could something arise out of nothing? This First Being alone, and without likeness, was the ALL in the beginning: he could multiply himself under different forms; he created fire from his essence, which is light, &c." So, in another passage of the Yagur Veid, "Thou art Brahma! thou art Vishnu! thou art Kodra! thou art Prajapat! thou art Deïonta! thou art air! thou art Andri! thou art the moon! thou art substance! thou art Djam! thou art the earth! thou art the world! O lord of the world, to thee humble adoration! O soul of the world! thou who superintendest the actions of the world! who destroyest the world! who createst the pleasures of the world! O life of the world! the visible and invisible worlds are the sport of thy power! Thou art the sovereign, O universal soul! to thee humble adoration! O thou, of all mysteries, the most mysterious! O thou who art exalted beyond all perception or imagination! thou who hast neither beginning nor end! to thee humble adoration!"‡

As this doctrine became embraced by many of the Greek and Roman philosophers, it is not to be wondered at that it captivated still more of their poets; and hence we find it, with perhaps the exception of Empedocles and Lucretius, more or less pervading all of them, from Orpheus to Virgil. It is in reference to this that Aratus opens his Phænomena with that beautiful passage which is so forcibly appealed to by St. Paul in the course of his address to the Athenians on Mars-hill,§ of which I will beg your acceptance of the following version:—

From God we spring, whom man can never trace,
Though seen, heard, tasted, felt in every place;
The loneliest path, by mortal seldom trod,
The crowded city, all is full of God;
Oceans and lakes, for God is all in all,
And we are all his offspring.||

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* De Nat. Deor. l. 1.

† Tom. i. Paris, 1802.

‡ See Transl. of Lucr. i. p. 282.

§ Acts xvii. 28.

|| Εκ Διος αρχωμεσθα, τον ουδεποτ' ανδρες εωμεν
Αρῥητον· ηεσται δε Διος πασαι μεν αγυιαι,
Πασαι δ' ανθρωπων αγοραι· μεστη δε θαλασσα,
Και λιμενες· παντῃ δε Διος κεχρημεθα παντες·
Τȣ γαρκαι γενος εσμεν. Lib. i. 1.

So Æschylus, in a passage still stronger in point, and imbued with the full spirit of Brahmism :—

Jupiter is the air ;
Jupiter is the earth ;
Jupiter is the heaven ;
All is Jupiter.*

But perhaps the passage most express is one contained in a very ancient Greek poem entitled De Mundo, and ascribed to Orpheus, in the original highly beautiful, and of which, for want of a better, I must trouble you with the following translation :—

Jove first exists, whose thunders roll above ;
Jove last, Jove midmost, all proceeds from Jove.
Female is Jove, immortal Jove is male ;
Jove the broad earth—the heaven's irradiate pale.
Jove is the boundless spirit, Jove the fire
That warms the world with feeling and desire.
The sea is Jove, the sun, the lunar ball ;
Jove king supreme, the sovereign source of all.
All power is his ; to him all glory give,
For his vast form embraces all that live.†

This doctrine has not been confined to ancient times, or to the boundaries of India and the republics of Greece and Rome ; it has descended through every age, and has its votaries even in the present day. M. Anquetil du Perron, whom I have already spoken of, as the Latin translator of the Oupnek'-hat, or Upanishad, from the Persian version, has himself distinctly avowed an inclination to it ; the writings of M. Neckar are full of it ;‡ and M. Isnard has professedly advanced and supported it in his work, "Sur l'Immortalité de l'Ame," printed at Paris in 1802. I do not know that it exists at present to any great extent in our own country ; but if we look back to something less than a century, we shall find it current among the philosophers of various schools, and especially that of which Lord Bolingbroke has been placed at the head ; and hence running through every page of the celebrated Essay on Man, in the composition of which it is probable that Mr. Pope was imposed upon by his noble patron, and was not sufficiently alive to the full tendency of its principles. The critics on the continent, however, perceived the tendency on its first appearance, and hence its author was generally, though incorrectly denominated the modern Lucretius, and the poem itself was regarded as one of the most dangerous productions that ever issued from the press ; as a most insidious attempt, by confining the whole of our views, our reasonings, and our expectations to the present state of things, to undermine the great doctrines of a future state and the immortality of the soul. In our own day we allow to it a very liberal extent of bold imagery and poetic license, and with such allowance it may be perused without mischief; but a few verses alone are sufficient to prove its evil bearing, if strictly and literally interpreted. The following distich, for example, beautiful as it is in itself, discloses the very quintescence of Spinosism :—*

---

* *Ζευς εστιν αιθηρ,*
Ζευς τε γη·
Ζευς δε ουρανος,
Ζευς τα παντα.

† *Ζευς πρωτος γενετο, Ζευς ὥστατος αρχικεραυνος*
Ζευς κεφαλη, Ζευς μεσσα· Διος δ' εκ παντα τετυκται,
Ζευς αρσην γενετο, Ζευς αμβροτος επλετο νυμφη·
Ζευς ποθμην γαιης τα και ουρανου αστεροεντος·
Ζευς πνοιη παντων· Ζευς ακαματα πυρος ορμη·
Ζευς ποντου ριζα· Ζευς ἐλιος ἐδε σεληνη·
Ζευς βασιλευς· Ζευς αυτος απαντων αρχιγενεθλος'
'Εν κρατος εις Δαιμων γενετο, μεγας αρχος απαντων'
Παντα γαρ εν μεγαλω Ζηνος ταδε σωματι κειται. Ex. Apul.

‡ See Sir W. Jones's Works, i. p. 448.

> All are but parts of one stupendous whole,
> Whose body nature is, and God the soul:

and the general result drawn from the entire passage which is too long to be quoted, is no less so :—

> In spite of pride, in erring reason's spite,
> One truth is clear, WHATEVER IS, IS RIGHT.

If every thing be right at present, there is no necessity for a day of correction or retribution hereafter ; and the chief argument afforded by nature in favour of a future existence is swept away in a moment. Unite the propositions contained in these two couplets, and illustrated through the whole poem, and it follows that the universe is God, and God the universe ; that amidst all the moral evils of life, the sufferings of virtue, and the triumphs of vice, it is in vain to expect any degree of compensation or adjustment in a future state ; every thing being but an individual part of one stupendous whole, which could not possibly exist otherwise ; and that the only consolation which remains for us under the pressure of pain or calamity is, that if *we* are not at ease, there are others that are so—that if *our* own country is devoured by war, or desolated by pestilence, there are countries remote from us that know nothing of such afflictions—that the *general good* is superior to the *general evil*, and made to flow from it, and, consequently, that *whatever is, is right*:—

> If plagues and earthquakes break not heaven's design,
> Why then a Borgia or a Cataline?

The THIRD HYPOTHESIS to which I have referred, is that of the idealists, or those who maintain that there is no such thing as a material or external world ; that the existence of man consists of nothing more than impressions and ideas, or of pure incorporeal spirit, which surveys every thing in the same unsubstantial manner as the visions of a dream. Some of the tenets of Malbranche appear to have a tendency to this theory ; but it has been chiefly developed in modern times by Bishop Berkeley and Mr. Hume. Their premises are indeed somewhat different, but their conclusion is the same ; excepting that the argument is pressed much farther by the latter than was ever intended by the former, and leads to more dangerous consequences. In Germany, Professor Kant has allowed a part of his tenets, as well as parts of various other tenets,† to enter into his system, or that which he chooses to distinguish by the name of the *Transcendental Philosophy*, and which not long since bade fair to obtain an universal sway over the continent, though for some years it has appeared to be considerably declining in its reputation. It was my intention to have traced the origin of the ideal hypothesis, and to have pointed out its sophisms, but our time will not allow me; and it is the less necessary, as I shall have an opportunity, on a future occasion, of reverting to all these various conjectures, and examining them at full length.*

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* See the author's prolegomena to his translation of the Nature of Things, p. cxxvi.
† Degerando, Hiotoire Comparee des Systemes de Philosophie, tom. ii. 17.

But why, after all, is it necessary to support the proposition, that "nothing can spring from nothing?" Why may not *something spring from nothing*, when the proposition is applied to Omnipotence?† I may be answered, perhaps, because it is a self-contradiction, an impossibility, an absurdity. This, however, is only to argue in a circle; for why is it a self-contradiction, or an impossibility? "It is impossible," said M. Leibnitz, "for a thing to be and not to be at the same time." This impossibility I admit; because, to assert the contrary, would imply a self-contradiction absolute and universal, founded upon the very nature of things, and consequently applicable to Omnipotence itself. But the position that "nothing can spring from nothing" is of a very different character: it is necessarily true when applied to man, but it is not necessarily true when applied to God. Instead of being *absolute* and *universal*, it is *relative* and *limited;* the nature of things does not allow us to reason concerning it when its reference is to the latter: and hence we have no authority to say that it is impossible to the Deity; or to maintain that an absolute creation out of nothing by the Deity is an absurdity or self-contradiction. It is absurd to suppose that matter does not exist; it is absurd to suppose that it does exist externally and independently of the Creator; it is absurd to suppose that it constitutes the Creator himself: but, as it is not absurd to suppose its absolute formation out of nothing by the exercise of an Almighty power, and as one of these four propositions must necessarily be true, reason should induce us to embrace the last with the same promptitude with which we reject the other three.

So far, indeed, from intimating any absurdity in the idea that matter may be created out of nothing by the interposition of an almighty intelligence, reason seems, on the contrary, rather to point out to us the possibility of an equal creation out of nothing of ten thousand other substances, of which each may be the medium of life and happiness to infinite orders of beings; while every one may, at the same time, be as distinct from every other, as the whole may be from matter, or as matter is from what, without knowing any thing farther of, we commonly denominate spirit. Spirit, as generally used among modern metaphysicians, is, to say the most of it, but a negative term employed to express something that is not matter; but there may be ten thousand somethings, and substrates of being, and moral excellence and felicity, which are not matter, none of which, however, we can otherwise characterize. Yet why, between all or any of these and matter itself, there should be such an utter opposition and discrepance as was contended for by Des Cartes, and has since been maintained by most metaphysicians, I cannot possibly conjecture; nor conceive why it should be universally thought necessary, as it still appears to be thought, that the essence of the eternal Creator himself must indispensably consist of the essence of some one of the orders of beings whom he has created.—Why may it not be as distinct from that of an archangel as from that of a mortal? from the whole of these various substances, which I have just supposed, and which we cannot otherwise contemplate or characterize than by the negative term Spirit, as it is from matter, which is more immediately submitted to our eyes, and constitutes the substrate of our own being and sensations?

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* Series III. Lect. V. p. 405.

† See the Author's Prolegomena, et supra, p. lxxviii.

Matter, then, we are compelled to regard as a substance created out of nothing by an intelligent first cause; himself immaterial, self-existent, eternal, and alone; and of matter the whole visible universe is composed. It is arranged and regulated by an extensive code of laws, of which, however, we know but a few; and which give birth to a multiplicity of concrete forms, under which alone we are capable of contemplating it; for no effort has hitherto succeeded in ultimately enucleating the compound and tracing it to its elementary particles. We may divide and subdivide as we please; but when we have followed it up into its subtlest rudiments, its most retiring principles, by the aid of the best glasses which the best art of man can provide for us, we learn no more of the real nature of its primitive essence than we do from an acorn or a pebble.

But we are as ignorant of matter in its total scope as we are of it in its elementary particles. We can examine it as it exists in the globe, but the globe on which we tread is but as a drop to the ocean; the earth is surrounded by other planets, by other worlds, by other systems of worlds; all of which, we have reason to believe, are composed of the same substance, and regulated by the same laws. We stretch out our view on every side, but there are still worlds beyond us; we call in the aid of the best glasses, but they still surpass our reach; till, at length we resign ourselves to imagination, and in the confusion of our thoughts and the weakness of our language we speak of space as being filled, and of matter as being infinite.

This view of the subject has given rise to a variety of magnificent speculations, at which I shall just glance, without meaning to dwell upon them. Is all this immensity of matter, this universe of worlds within worlds, and systems within systems, the result of one single fiat of the great Creator? Did the Power that spake it into existence give it from the first the general order and harmony and perfection that prevail at present? or did he merely produce a vast central and aggregate chaos, as the rude basis of future worlds, the parent-stock or storehouse from which they have since issued by a series of distinct efforts and evolutions? or, thirdly, has every separate system of worlds, or every separate planet, been the result of a separate birth, and a separate act of creation?

It is of little importance which of these splendid fancies we adopt; for all of them are but fancies, and built upon conjecture alone. In a course of philosophical inquiry, however, it becomes us to be acquainted with their existence; and to be informed, beyond this, that the second is the speculation which has been more generally espoused by philosophers; that, I mean, which conceives the existence of a central and primary chaos, from which all the heavenly bodies have successively proceeded, of whatever kind or description, whether suns, stars, comets, or planets; though the mode by which such efforts have been produced has been variously accounted for. Des Cartes seems to have supposed stars to have preceded planets in the order of creation; and that the earth was at first a star, and continued so till rendered opake by having its bright surface encrusted with grosser and untransparent matter, and drawn into the vortex of the solar system; and Leibnitz adopted his conjecture. Whiston conceived it to have been originally a comet, the rude materials of which constituted the chaos of the earth; and Buffon, to have consisted of a comet and a portion of the sun's exterior limb or edge carried off by such comet, in consequence of its having given the sun an oblique stroke in the course of its orbit; the chaos of the earth being thus formed by the vapoury substance of the impinging comet uniting with a portion of the sun's igneous mass; and in this man-he endeavoured to account for the production of every other planet of the solar system.

But of all this class of speculations, (for assuredly they deserve no higher character,) the most splendid and comprehensive is that which was first embraced by Dr. Herschel, and was perhaps an improvement on a prior hypothesis of M. Buffon; but which, so precarious is the life of a philosophical hypothesis, he himself discarded, not many years afterwards, for something newer. It supposes the existence of an immense mass of opake but igneous matter, seated in the centre of universal nature; that the sun and every other star were originally portions of this common substance; but it is volcanic in its structure, and subject to eruptions of inconceivable force and violence; that the sun and every other luminary of every other system were thrown forth from it at different times, by the operation of such projectile powers; and that these, possessing in a great degree the qualities of the parent body, threw forth afterwards at different times, by means of similar volcanoes, portions of their own substance, each of which, by the common laws of projectiles, assumed an orbicular motion, constituted a distinct planet, and became the chaos of a rising world.* Hence, according to this comprehensive and daring hypothesis, the existing universe has acquired its birth; hence new systems of worlds are perpetually rising into being, and new planets are added to systems already created.

But worlds and systems of worlds are not only perpetually creating, they are also perpetually diminishing and disappearing. It is an extraordinary fact, that within the period of the last century, not less than thirteen stars in different constellations, none of them below the sixth magnitude, seem totally to have perished; forty to have changed their magnitude by becoming either much larger or much smaller; and ten new stars to have supplied the place of those that are lost.† Some of these changes may perhaps be accounted for by supposing a proper motion in the solar or sidereal systems, by which the relative positions of several of the heavenly bodies have varied. But this explanation, though it may apply to several of the cases, will by no means apply to all of them; in many instances it is unquestionable, that the stars themselves, the supposed habitations of other kinds or orders of intelligent beings, together with the different planets by which it is probable they were surrounded, and to which they may have given light and fructifying seasons, as the sun gives light and fruitfulness to the earth, have utterly vanished, and the spots which they occupied in the heavens have become blanks. What has thus befallen other systems will assuredly befall our own; of the time and the manner we know nothing, but the fact is incontrovertible; it is foretold by revelation, it is inscribed in the heavens, it is felt throughout the earth. Such is the awful and daily text; what then ought to be the comment?

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* Phil. Trans. vol. lxxxiv.

‡ See Dr. Herschel's Observations compared with Flamsteed's, Phil. Trans. vol. lxxiii. art. 17.

LECTURE II.

ON THE ELEMENTARY AND CONSTITUENT PRINCIPLES OF THINGS.

Our study for the present lecture is the first or simplest principles of bodies, so far as we have hitherto been able to obtain any degree of knowledge upon this recondite inquiry, and the means by which they are combined or separated from each other, so as to produce different kinds and orders of sensible objects.

A very slight contemplation of nature is sufficient to show us that matter under every visible form and modification, when regarded in its general mass, is perpetually changing; alternately living, dying, and reviving; decomposing into elements that elude our pursuit; and recombining into new shapes and energies and modes of existence. The purest and most compact metals become tarnished or converted into a calx or oxyde on its surface, and the most durable and crystallized rocks crumble into granules; and the matter constituting these oxydes and granules, by an additional series of operations, is still farther decomposed, till every vestige of their late character is lost, and the elementary principles of which they consisted are appropriated to other purposes, and spring to view under other forms and faculties. The same process takes place in the organized world. The germ becomes a seed, the seed a sapling, the sapling a tree; the embryo becomes an infant, the infant, a youth, the youth a man: and having thus ascended the scale of maturity, both, in like manner, begin the downward path to decay; and, so far as relates to the visible materials of which they consist, both at length moulder into one common elementary mass, and furnish fresh fuel for fresh generations of animal or vegetable existence; so that all is in motion, all is striving to burst the bonds of its present state; not an atom is idle; and the frugal economy of nature makes one set of materials answer the purpose of many, and moulds it into every diversified figure of being and beauty and happiness.

It has hence been said, that matter is necessarily corruptible, and is perpetually changing from its intrinsic nature, and that the physical and moral evils of life, are mainly attributable to this perverse and incorrigible propensity. Such was the doctrine of many of the most eminent schools of ancient philosophy, both of Greece and Asia, and such continues to be the doctrine of various schools of the present day; a doctrine which has not unfrequently been considered as of the utmost importance, and as forming the best defence of the benevolence of the Supreme Architect; who, we are told, notwithstanding all the pains and calamities, the tumults and disorders of nature, has made the most of matter that it would admit of, and has tempered it not only with a positive predominancy of good over evil, but with as much and as real good as could possibly be infused into it.

To argue thus, is to revive the theory of pure Platonism, far too extensively introduced into the Christian world, as I hinted in our last lecture, upon the first conversion of the Grecian philosophers who had been chiefly students in the Platonic school; and to suppose the existence of matter as an independent and eternal principle. "God," says the sublime but mistaken founder of this school, "wills, *as far as it is possible*, every thing good and nothing evil:"* "but it cannot be that evil should be destroyed, for there must always be a something contrary to good,"* a ξυμφυτος επιθυμια, "an innate propensity to disorder,"† in that eternal and independent principle of matter, out of which all visible things are created.

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* Thœt. t. i. p. 176.

How much more consolatory, as well as agreeable to right reason, is the view taken of this abstruse subject in the pages of genuine, unsophisticated, and unphilosophised revelation, in which the present is represented as a state, not of actual necessity, but of pre-ordained probation; willed, in infinite wisdom, by the great first cause, to promote the best ultimate happiness of man; and matter as a substance produced out of nothing by his almighty fiat! It was one of the express objects of the preceding lecture to prove not only that matter does exist, in opposition to those who have thought it expedient to deny the being of a sensible and material world, but that it could not exist by any other means; and that, while there is no self-contradiction or absurdity in contending that matter, and that ten thousand other substances than matter, may be produced out of nothing by the energy of an infinite and omnipotent intelligence, there is so pure and perfect an absurdity in endeavouring to account for its existence upon every other theory which has hitherto been invented, that right reason should induce us to embrace the former opinion with the same promptitude with which we fly from every opinion that opposes it.

Matter, then, is the production of an almighty intelligence, and as such is entitled to our reverence; although, from a just abhorrence of many ancient and not a few modern errors, it has too often been regarded in a low and contemptible light. Though not essentially eternal, as was contended for by all the schools of Greece and Asia, nor essentially intelligent, as was contended for by several of them, it evinces in every part and in every operation the impress of a divine origin, and is the only pathway vouchsafed to our external senses by which we can walk—

Through nature up to nature's God;

that God whom we behold equally in the painted pebble and the painted flower—in the volcano and the corn-field—in the wild winter-storm and in the soft summer moonlight. Although when contemplated in its aggregate mass, and especially in its organized form, it is perpetually changing, it is every where perfect in its kind, and even at present bears indubitable proofs of being capacified for incorruptibility. In its elementary principles it is maintained by the best schools of both ancient and modern times to be solid and unchangeable; and, even in many of its compound forms, it discovers an obvious approach to the same character. The firm and mighty mass that constitutes the pyramids of Egypt has resisted the assaults of time and of tempests for, perhaps, upwards of four thousand years, and by many critical antiquaries is supposed to have triumphed over the deluge itself. While there is little doubt that the hard and closely crystallized granitic mountains of every country in which they occur, "the everlasting hills," to copy a correct and beautiful figure from the pages of Hebrew poetry, are coeval with the creation, and form at this moment, as they formed at first, the lowest depths as well as the topmost peaks of the globe. That they are in every instance considerably attenuated and wasted away admits, indeed, of no doubt; but to have borne the brunt of so long and incessant a warfare, without actually being worn down to the level of the circumjacent plains, affords no feeble proof of an almost imperishable nature, and a proof open to the contemplation of the most common capacities.

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* Id Theœt. t. i. p. 176.

† Phileb. See also Brucher, Hist. Phil. lib. ii. cap. viii. § 1.

There are various examples of the Macedonian stater or gold coin, struck in the reign of Philip, at this time preserved in the rich cabinet of the Florence gallery,* which, though they have continued in existence for at least 2200 years, do not appear to have lost any thing of their weight. Barthelemi, making a trivial mistake in the weight of the drachma, which he calculated at 66.55 grains English, suspected that these had sustained upon the average a loss of about seven-eighths of a grain during this long period; but as M. Fabbroni has since satisfactorily proved that the drachma was not more than 66.8 grains, and as this is the actual weight of several staters in this cabinet, we have a demonstration that they have sustained no diminution whatever.

Yet, in its liquid and gaseous state, matter often exhibits still more extraordinary instances of indestructibility or resistance to decomposition; and it should be especially remarked, that its indestructibility or indecomposable power appears to hold a direct proportion to its subtilty, its levity, its activity, its refined ethereal or spiritualized modification of being.

Water is as much a compound as any of the earths, yet we have strong reason for believing that for the most part it exists unchangeably from age to age; and that its integrity has been not essentially interfered with from the commencement of the world. Its constituent parts are by no means broken into, but continue the same whether under a solid form, as that of ice; under its usual form, as that of a liquid; or under an elastic form, as that of vapour: it is the same in the atmosphere as on the earth; it falls down of the very same nature as it ascends, and the electric flash itself appears, generally speaking, to have no other influence upon it than that of hastening its precipitation. It is only to be decomposed, that we know of, by a very concentrated action of the most powerful chemical agents; and even this, whether by art or by nature, upon a very limited scale.

A similar identity appears to exist in atmospheric air, which is, probably, at least as indestructible as water; for its composition, when purged of the heterogeneous substances which are often combined with it, is the same in the deepest valleys, as on the highest cliffs; at the equator and at the poles; the earth's surface, and the height of 21,000 feet† above it; in many of which situations, and especially the more elevated, it is impossible for it ever to be generated; since the constituent parts of which it is composed are not found to exist in a separate state for its production. It is capable, indeed, of decomposition; but, like water, becomes decomposed with great difficulty, and probably consists at this moment, as to its general mass, of the very identic particles that formed it on its first emerging from a state of chaos.

Of the composition of the subtler gases we know nothing. The specific weight of several of them has been ascertained, and the constituent principles of one or two of them, as nitrogene and hydrogene, have been guessed at, but nothing more; for the boldest experiments of chemistry have hitherto been exerted in vain to effect their decomposition. While as to those which are more immediately connected with the principle of animal life, and upon which many schools of modern philosophy have supposed it altogether to depend, as caloric, and the electric and voltaic fluids, the last of which seems in truth to be only a peculiar modification of the second, together with other substances or qualities which in subtilty and activity have a considerable resemblance to them, as light and the magnetic aura, we are not only wholly incapable of decomposing them by any process whatever, but even of determining them to be ponderable, or to possess any of the other common properties of matter, as extent and solidity. Whence we are, in fact, incapable of ascertaining whether they be matter at all, whether mere qualities of matter, or whether some other more subtle and spiritualized substances,* intermixing themselves under different combinations with the material mass, and giving birth to many of its most extraordinary properties and phænomena.

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* See Nicholson's Journal, vol. xxxii. p. 25.

† See Thomson's Chem. vol. iv. 64., as also Phil. Mag. xxi. 225.

The question is entered upon at some length by Professor Berzelius, in his "Explanatory Statement," published in the Memoirs of the Academy of Stockholm for 1812, in which he endeavours to support the probability that the electric fluids and caloric are material as well as the fluid of light; but, to do this, he is compelled to alter the common definition of matter, and to contend that matter does not necessarily possess gravitation or aggregation.†

The materiality of light has been attempted to be proved by its effects on solutions of muriate of ammonia and prussiate of potash, when placed in a situation to be crystallized. The crystallization of these salts may be directed at pleasure by the introduction of light at one or the other side of the vessels containing such solutions. Camphor displays a like affinity for light. All this, however, shows merely that light possesses an influence of some kind; but it by no means establishes that such influence is a material one.‡

Is it inquired to what important point these abstruse speculations lead? I may reply, among others, to the following:

First, to a probability, if not to a proof, that matter, under peculiar modifications, is capable of making an approximation to something beyond itself, as ordinarily displayed; and hereby of becoming fitted, whenever necessary, for an intercourse and union with an immaterial principle.

And, secondly, to a clearer view of the coincidence of natural phænomena with one of the most glorious discoveries of revelation. For notwithstanding that matter, under every visible shape and texture, is at present in a greater or less degree, perpetually changing and decomposing, the moment we perceive that this is not a necessary effect, dependent upon its intrinsic nature, but a beneficial power superadded to it for the mere purpose of rendering it a more varied and more extensive medium of being, beauty, and happiness—the moment we find ground for believing, that in its elementary principles it is essentially solid and unchangeable; and that even in many of its compounds it is almost as much exempted from the law of change—we are prepared to contemplate a period in some distant futurity, in which, the great object for which it has been endowed with this superadded power being accomplished, the exemption may extend equally to every part and to every compound: a period in which there will be new heavens and a new earth, and whatever is now corruptible will put on incorruption.

But what, after all, is matter in its elementary principles, as far as we are capable of following them up? Can it be divided and subdivided to infinity? or is there a limit to such divisibility, beyond which the process cannot possibly proceed? and if so, are the ultimate bodies into which it is capable of dissolving still susceptible of developement, or, from their attenuation, removed beyond all power of detection?

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* See Young's Lectures, vol. ii. p. 742. lect. lx.

† See Nicholson's Journal, vol. xxxiv. p. 164, 165.

‡ See Accum's Elements of Crystallography, and Tilloch's Phil. Mag. vol. xli. p. 367.

These are questions which have agitated the world in almost all ages, and have laid a foundation for a variety of theories of too much consequence to be passed over in a course of physical investigation.

The tenet of an infinite divisibility of matter, whether in ancient or modern times, appears to have been a mere invention for the purpose of avoiding one or two self-contradictions supposed to be chargeable upon the doctrine of its ultimate and elementary solidity; but which, I much fear, will be found to have given birth to far more self-contradiction than it has removed. The mode of reasoning, however, by which this tenet was arrived at in ancient Greece, was essentially different from that by which it has been arrived at in our own day.

It being, as we observed in our last lecture, an uncontroverted maxim among all the Greek philosophers, of every sect and school whatever, that nothing could proceed from nothing, matter was of course conceived to have existed eternally, or it could not have existed at all. But it appeared obvious to most of them, that matter is as certainly unintelligent as they conjectured it is certainly eternal. The existence of intelligence, however, is still more demonstrable throughout nature than the existence of matter itself; and hence such philosophers were driven to the acknowledgment of an intelligent principle distinct from a material substance; and from the union of these two powers they accounted for the origin of the world: matter being merely passive and plastic, and put into form and endowed with the qualities and properties of body by the energy of the intelligent agent. But if form and corporeal properties have been communicated to it, it must, before such communication, and in its first or primal state, have been destitute of form; and that it was thus destitute is incontrovertible, continued the same schools of philosophy, because form presupposes the existence of intelligence, and must be, under every shape and modification, the product of an intelligent energy; for it is impossible that matter could have had a power of assuming one mode of form rather than another mode: since, if capable of assuming any kind, it must have been equally capable of assuming every kind, and, of course, of exhibiting intelligent effects without an intelligent cause, which would be utter nonsense.

Such is the general train of reasoning that seems to have operated upon the minds of Pythagoras, Plato, and Aristotle, in impelling them to the belief that matter, in its primary state, to adopt the words of Cicero, in which he explains the Platonic doctrine, "is a substance without form or quality, but capable of receiving all forms, and undergoing every kind of change; in doing which, however, it never suffers annihilation, but merely a solution of its parts, which are in their nature infinitely divisible, and move in portions of space which are also infinitely divisible."*

But if we abstract from matter form and quality, and at the same time deny it intelligence, what is there left to constitute it an eternal substance of any kind? and by what means could pure incorporeal intelligence endow it with form?

These difficulties are insuperable; and, though attempted to be explained in different ways by each of these philosophers, they press like millstones upon their different systems, and are perpetually in danger of drowning them. Pythagoras compared the existence of matter, in its primary and amorphous state, to pure arithmetical numbers, before they are rendered visible by arithmetical figures. "*Unity*," says he, "and *one* (the former of which he denominated *monad*) are to be distinguished from each other: *unity* is an abstract conception, resembling primary or incorporeal matter in its general aggregate; one appertains to things capable of being numbered, and may be compared to matter rendered visible under a particular form." So again, "Number is not infinite any more than matter; but it is nevertheless the source of that infinite divisibility into equal parts which is the property of all bodies."*

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* Acad. Quæst. lib. i. cap. 8.

Numbers, however, were not more generally had recourse to by Pythagoras, to typify elementary matter under different modifications, than they are in the present day by the most elaborate chemists, to express its particular combinations: "As in all well-known compounds," observes Sir Humphrey Davy, "the proportions of the elements are in certain definite ratios to each other, it is evident that these ratios may be expressed by numbers."† In consequence of which they are so expressed in various places by himself, and by many French, Swedish, and English chemists, the hint having been first suggested, I believe, by Higgins or Dalton. And hence the doctrine of numbers is well known to have been very largely and very repeatedly had recourse to under the Pythagorean system, and to have been used in explanation, not only of the endowment of different portions of matter with different forms, but of the harmony with which the different natures of matter and mind unite in identic substances. Numbers and forms are, in consequence, not unfrequently contemplated as the same thing—as the models or archetypes after which the world in all its parts is framed—as the cause of entity to visible beings: *τους αριθμους αιτιους ειναι της ουσιας.*‡

And hence, again, under the term monad, or unity, Pythagoras is generally conceived to have symbolized God, or the active principle in nature; under duad, the passive principle, or matter; and under triad, the visible world, produced by the union of the two former.

Pythagoras, however, was as much attached to music as to numbers, regarding it as a mere branch of the science of numbers applied to a definite object. He has, indeed, the credit of having invented the monochord, and of having applied the principles of music, as well as those of numbers, to the study of physics. He conceived that the celestial spheres, in which the planets move, striking upon the elastic ether through which they pass, must produce a sound, and a sound that must vary according to the diversity of their magnitude, velocity, and relative distance; and as the adjustment of the heavenly bodies to each other is perfect in every respect, he farther conjectured, that the harmony produced by their revolutions must also be the most perfect imaginable; and hence the origin of a notion, which is now, however, only entertained in a figurative sense, a sense frequently laid hold of by our own poets, and thus exquisitely enlarged on by Dryden:—

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* Anon. Photii, lib. c. Nicomac. apud Phot. Themist. in Phys. lib. iii. sect. 25. p. 67. See also Enfield's Brucker, i. b. ii. ch. 12. p. 383.

† Davy, Elem. i. p. 112.

‡ Arist. Met. lib. i. c. 6. Plut. Plac. Phil. lib. i. cap. 3. Athenag. Apol. 49.

From harmony, from heav'nly harmony,
This universal frame began.
When nature underneath a heap
Of jarring atoms lay,
And could not heave her head,
The tuneful voice was heard from high,
Arise, ye more than dead!
Then hot and cold, and moist and dry,
In order to their stations leap,
And music's power obey.
From harmony, from heav'nly harmony,
This universal frame began;
From harmony to harmony
Through all the compass of the notes it ran,
The diapason closing full in man.

What Pythagoras thus called numbers Plato denominated *ideas*, a term which has, hence, descended to our own day, and is on every one's lips, although in a different sense from what it originally imported. The reason or wisdom of the great First Cause, and which he denominates the logos of God, ὁ λογος, or ὁ λογισμος του Θεου, and not unfrequently Δημιουργος (Demiurgus), Plato describes as a distinct principle from the original Cause or Deity himself, from whom this efficient or operative cause, this divine wisdom or logos, emanates, and has eternally emanated, as light and heat from the sun. Thus emanating, he conceived it to be the immediate region or reservoir of ideas or intellectual forms, of the archetypes or patterns of things, subsisting by themselves as real beings—τα οντως οντα—in this their eternal and original well-spring; and the union of which with the whole, or any portion of primary or incorporeal matter, immediately produces palpable forms, and renders them objects of contemplation and science to the external senses.*

~~It is~~, hence, obvious that Plato contended for a triad or trinity of substances in the creation of the visible universe—God, divine wisdom, or the eternal source of intellectual forms or ideas, and incorporeal matter. And it is on this account that several of the earliest Christian fathers, who, as I have already observed, had been educated in the Platonic school, and had imbibed his notions, regarded this doctrine as of divine origin; and endeavoured, though preposterously, to blend the trinity of Plato, and that of the Christian scripture, into one common dogma: an attempt which has been occasionally revived in modern times, especially by Cudworth and Ogilvie, with great profundity of learning and great shrewdness of argument, but, at the same time, with as little success as in the first ages of Christianity.

It is to this theory, which, indeed, is highly fitted for poetry, and much better so than for dry, dialectic discussion, Akenside beautifully alludes in the first book of his "Pleasures of Imagination:"—

Ere the radiant sun
Sprang from the east, or, mid the vault of night
The moon suspended her serener lamp;
Ere mountains, woods, or streams adorn'd the globe,
Or Wisdom taught the sons of men her lore;
Then liv'd th' Eternal ONE; then, deep retir'd
In his unfathom'd essence, view'd the forms,
The forms eternal of created things;
The radiant sun, the moon's nocturnal lamp,
The mountains, woods, and streams, the rolling globe,
And Wisdom's mien celestial. From the first
Of days, on them his love divine he fix'd,
His admiration; till, in time complete,
What he admir'd and lov'd his vital smile

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* Plac. Phil. lib. i. cap. x. Tim. lib. c.

Unfolded into being. Hence the breath
Of life in forming each organic frame;
Hence the green earth, and wild resounding waves;
Hence light and shade alternate; warmth and cold;
And clear autumnal skies, and vernal showers;
And all the fair variety of things.

While, however, we thus point out the fancifulness and imperfections of these hypotheses, let us, with the candour of genuine philosophy, do justice to the merits of their great inventors, and join in the admiration which has been so duly bestowed upon them by the wise and learned of every country. It was Plato who first suggested to Gallileo, even upon his own confession, that antagonist power by which a rectilinear motion can be converted into an orbicular, and thus laid a basis for our accounting for the regular movements of the heavenly bodies,[*] a subject upon which we shall enter to a certain extent in our next lecture; who, in some degree, anticipated that correct system of colours which nothing but the genius of a Newton could fully develope and explain;[†] who in mathematics unfolded to us the analytic method of solving a problem,[‡] and in theosophy so far surpassed all the philosophers of his country, in his correct views and sublime descriptions of the Deity, that he seems almost to have drunk of the inspiration of Horeb or of Sinai; and who, in his Timæus, applies to the wisdom of God, the *λογισμος του Θεου*—a term which in Hebrew could scarcely be translated by any other word than that of Jeveh or Jehovah —*πας οντως αει*,[§] "WHATEVER IS ESSENTIALLY ETERNAL."

Of Pythagoras, it is only necessary to direct the attention to the two following very extraordinary facts, to place him beyond the reach of panegyric; the first of which has occasionally furnished reflection for other writers, though the latter remains unnoticed to the present moment. At an antedate of two thousand two hundred years from the age of Copernicus, this wonderful genius laid the first foundation of the Copernican system, and taught to his disciples that the earth revolves both around her own axis and around the sun; that the latter motion is conducted in an oblique path or zodiac;[‖] and that the moon is an earth of the same kind as our own, and replete with animals, whose nature, however, he does not venture to describe.[¶]

The second extraordinary fact to which I allude, is one we have already slightly glanced at, but which must not so cursorily be relinquished; I mean that, in ascribing to the primary or elementary forms of bodies, in their unions with each other, relative proportions so exact, yet so diversified, that forms and numbers may be employed as synonyms or convertible terms, he has exhibited so close a coincidence with one of the latest and most surprising discoveries of the present day, that though I dare not call it an anticipation, I am at a loss how else to characterize it: for it has been minutely ascertained within the last ten or twelve years, by an almost infinite variety of accurate and well-defined experiments by Higgens, Dalton, Gay Lussac, and Davy, that the combinations and separations of all simple bodies are conducted in a definite and invariable ratio of relative weight or measure;* as that of one part, to one part, one part to two parts, one to three, or one to four; and, consequently, that every change in the compound thus produced, whether of addition or diminution, is a precise multiple or divisor of such ratio; or, in other words, that the different elementary bodies which enter into such compounds can never unite or separate, never lay hold of or let go each other, in any other proportions.

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[*] Galilei Discorsi e Dimostrazioni Matematiche, p. 254. 4to. Leyd. 1638. Dutens, Origine des Decouvertes, &c. p. 90. 4to. Lond. 1796.

[†] Plut. de Placitis Philos. lib. i. cap. 15. p. 32. Dutens, ut supr. p. 101.

[‡] Dutens, ut supr. p. 251.

[§] Plutarch. in Tim. lib. iii. 34. 37.

[‖] Plutarch. de Placitis, lib. iii. cap. 11. 13. Diog. Laert. lib. viii. sect. 85. Copernicus himself admits that he derived his first hint of the earth's motion from Nicetas, a follower of Pythagoras. Vide his address to Paul III.

[¶] Plutarch. de Placit. Cicer. Acad. Quæst. lib. iv. p. 984. col. 1. Something of this doctrine is to be found in the Orphic Hymn. Procl. de Orpheo, lib. iv. in Timæum, p. 154.

Let us exemplify this remark by a familiar instance or two. It is now well known to every one, that the calxes, oxydes, or, as they are often called, rusts, of metals, consist of a certain portion of oxygene with a certain portion of the metal, which is thus converted into a calx or oxyde. It is also known in the present day to most persons, that the greater number of metals are possest of two or more kinds of oxydes, produced by an union of different proportions of the oxygene and the metal, and often distinguishable even by their colour; as minium or red lead, and cerusse or white lead, which are equally oxydes of the metal whose name they bear. Now, in whatever proportion the oxygene unites with the metal to produce an oxyde of one kind, it invariably unites by a multiple or divisor of the same proportion to produce every kind of oxyde belonging to the same metal. Thus we have discovered not less than four different oxydes of antimony in different parts of the world: the lowest or simplest of them contains 4½ parts of oxygene to 100 parts of metal; the next simplest contains 18 parts of oxygene to 100 parts of metal, which is four times 4½; the third oxyde consists of 27 parts of oxygene to 100 parts of metal, which is six times 4½; and the fourth oxyde, 36 parts of oxygene to 100 parts of metal, which is eight times 4½. So tin, which possesses three discovered oxydes, has for its lowest the proportion of 7 parts of oxygene to 100 parts of metal; for its second oxyde, 14 parts of oxygene to 100 parts of metal, which is twice 7; and for its highest, 21 parts of oxygene to 100 parts of metal, which is three times 7. I have given the proportions in round numbers; but if I were to use the fractions that belong to them, the comparative results would be precisely the same. Nor can we possibly combine these substances in any other proportions so as to produce oxydes, for the corpuscles of which they consist will not lay hold of or let go each other in any other ratios. It is possible that we may hereafter detect an oxyde of antimony consisting of a less proportion of oxygene than 4½; but if we ever should, we are confident beforehand that such proportion will be 2¼. It is also possible that we may meet with an oxyde containing more than 4½ and less than 18 parts of oxygene in 103; but if we should do so, we can nearly anticipate that such proportion will be 9. And hence, as these proportions, though constantly true to their respective series, are constantly diversified in different substances, their radical figures or numbers may be employed, and now actually are employed, and that very generally, and in perfect coincidence with the system of the Pythagorists, as synonyms of the simple forms or substances whose progressive character they describe. This curious coincidence of ancient and modern philosophy, for at present I will call it nothing more, I cannot but regard as a very marvellous fact; and am not a little surprised that it should not hitherto have occurred, as it does not appear to have done, to the minds of any of those learned and ingenious chemists who have chiefly been employed in applying and building up the discovery. And it is not the least important part of this discovery, that not only in the union or separation of simple substances, but in all well-known and more complicated compounds, so far as the experimental series has been carried, the elementary bodies which enter into them exhibit proportions equally definite and invariable ; thus affording another proof of close connexion between the phænomena of nature and the occasional developements of revelation ; the philosopher beholding now, as the prophet beheld formerly, that the Almighty Architect has literally adjusted every thing by weight and measure ; that he has measured the waters and meted out the heavens, accurately comprehended the dust of the earth, weighed the mountains in scales and the hills in a balance.

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* The only apparent exception I am aware of to this general principle is in the combination of the elements of M. Dulong's detonating substance, or azotane, as described by Sir Humphrey Davy, Phil. Trans. for 1813, p. 250: and it is, hence, probable that we are not yet put into possession of the proper results.

LECTURE III.

ON THE ELEMENTARY AND CONSTITUENT PRINCIPLES OF THINGS.

(The subject continued.)

The few steps we have hitherto taken in the wide and magnificent scope before us have only led to an establishment of two or three fundamental axioms, of no small importance in the science of physics, and to a developement of two or three of the most ingenious and most popular hypotheses of former times, invented to account for the origin of the world around us, and the elementary and constituent principles of things ; especially the hypothesis of numbers, as proposed by Pythagoras, and that of ideas, as proposed by Plato ; and their application to primary and incorporeal matter, in order to endow it with form and quality. There are yet two or three other hypotheses upon the same subject that amply demand our attention, and are replete with an equal degree of ingenuity and fine imagination ; especially the Peripatetic and the Atomic, or that of Aristotle and that of Epicurus ; and we have also to trace out the relative degree of influence which each of these has exerted on the philosophical theories of later times.

Aristotle had too much penetration not to see that the hypothesis of Plato was just as inadequate as that of Pythagoras to a solution of the great question concerning the production of the visible world : and he proposed a third scheme, which has also had its share of popularity. According to this remodelled plan, the sensible universe is the result of four distinct principles,—intelligence, matter, form, and privation ; which last term is little more than a mere synonym for space or vacuum ; and thus far the theory of Aristotle chiefly differs from that of Plato, by interweaving into it his fourth principle, derived from Democritus, and the other Atomic philosophers, and which he seems to have added to it with a view of providing a proper theatre for the two principles of form and matter to move in. He supposes all these to have equally existed from eternity ; and the three last to have been eternally acted upon or thrown into a definite series of motions, upon which alone the existence and harmony of things are dependent, by the immutable and immaterial principle of intelligence, whose residence he places in the purest and loftiest sphere or circle of the heavens; a sphere that in its vast embrace comprehends ten lower or subordinate spheres, that lie between itself and the earth, which forms the centre of the whole, and, in conjunction with the earth, constitutes the universal world.

This supreme intelligence Aristotle conceived to be in himself for ever at rest; and the tranquil and peaceable sphere in which he resides he denominated the empyreum or heaven of bliss. But though enjoying eternal rest himself, he communicates motion, necessarily and essentially, upon this theory, to the sphere immediately below him; as this, in its turn, communicates it in different directions, and with different velocities, to the other spheres that revolve within its range;* whence the sphere thus earliest receiving motion, and nearest to the empyreum, Aristotle denominated the PRIMUM MOBILE or first moving power: it constituted the tenth in the regular series; the ninth, or that which lies next to it, being denominated the crystalline heavens; the eighth, the starry sphere, or heavens; and the remaining seven deriving their names from, and being appropriated to, the different revolutions of the different planets, as Saturn, Jupiter Mars, Apollo or the sun, Venus, Mercury, and Diana or the moon: the earth, forming the centre of the whole, being an imperfect sphere, with a larger proportion of matter at the equator; on which account the earth was conceived to turn on her axis in a rocking motion, revolving round the axis of the eliptic, and making the stars appear to shift their places at the rate of about one degree in seventy-two years. According to which calculation, all of them will appear to perform a complete revolution in the space of 25,920 years, and, consequently, to return to the precise situation they occupied at the commencement of such period. This period was hence denominated the ANNUS MAGNUS, or GREAT YEAR, and not unfrequently the PLATONIC YEAR, as the same kind of revolution was in some measure taught also by Plato.

The motory power, thus impressed by the intelligent moving principle, not voluntarily but by necessity, upon the different heavenly spheres, and finally upon the earth, and productive of that catenation of effects which is equally without beginning and without end, Aristotle denominated NATURE, and thus furnished us with a word, which has for ages been so extensively made use of, that, though there is nothing in all language more imprecise, there is nothing we could spare with more inconvenience. The same term, indeed, is occasionally employed by Plato, but in a sense still less definite, if possible, and at the same time still less comprehensive.

On the revival of literature, this theory, together with the other branches of Peripatetic science, was chiefly restored and studied, and continued, indeed, to be generally adhered to for upwards of a century after the publication of the Copernican system; which is well known to have at first experienced but a very cold and inhospitable reception from the literary world. And it is hence this theory that is principally adverted to and described in the productions of all the early poets as well as philosophers of every part of modern Europe. And so complete was the triumph of the Peripatetic school in all its doctrines throughout Christendom, at this period, that Melancthon makes it a matter of complaint, that, even in the sacred assemblies, parts of the writings of Aristotle were read to the people instead of the Gospel. Even Milton himself, though born considerably more than a century after Copernicus, wavers as to the propriety of adopting his hypothesis of the heavens, and hence, in his Paradise Lost,* leaves it doubtful which of the two, the new or the old, ought to be preferred. The best and most splendid description of the Aristotelian theory that I have ever met with is contained in the Lusiad of Camoens; the whole is too long for quotation, but I may venture to affirm, that you will be pleased with the following lines from Mr. Mickel's very spirited version of the Portuguese bard, as delineating the different heavenly spheres that were supposed, as I have already observed, to lie one within another, like the different tunics of an onion :—

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* Diog. Laert. lib. v. sec. 23. Arist. Phys. lib. 1. cap. 3, 4. De Cæl. lib. 2. cap. 3. 11.

> These spheres behold: the first in wide embrace
> Surrounds the lesser orbs of various face;
> The EMPYREAN this, the holiest heaven,
> To the pure spirits of the blest is given:
> No mortal eye its splendid rays may bear,
> No mortal bosom feel the raptures there.
> The earth in all her summer pride array'd
> To this might seem a dark, sepulchral shade.
> Unmov'd it stands—Within its shining frame,
> In motion swifter than the lightning's flame,
> Swifter than sight the moving parts may spy,
> Another sphere whirls round its rapid sky:
> Hence MOTION darts its force, impulsive draws,
> And on the other orbs impresses laws.†

These hypotheses are abstruse, and perhaps ill calculated to afford amusement; but in a course of physical study they ought by no means to be overlooked. Abstruse as they are, the one or the other of them is interwoven with the whole range of classical literature, and, as I have already remarked, held the ascendant in the horizon of metaphysics till within the last two centuries; and I have dwelt upon them the rather, because, much as we still hear of them, and find them adverted to in books, I am not acquainted with any work whatever that gives any thing like a clear and intelligible summary of their principles. Their more prominent defects are, in few words, as follows: Independently of conveying very imperfect and erroneous views of the creation, they equally concur in reducing matter, notwithstanding its pretended eternal existence, to a nonentity, and confound its properties with those of pure intelligence, by giving to numbers, ideas, or a mere abstract notion, real form and existence. The most powerful advocate of the Platonic theory, in modern times, was the very excellent Bishop Berkeley; who, in the true spirit of consistency, and with a boldness that no consequences could deter, openly denied the existence of a material world, and thus reduced the range of actual entities from three to two, an intelligent first cause, and intellectual forms or ideas, and gave the death-blow to the system, by avowing its necessary result.

In modern times, however, as I have already hinted at, the infinite divisibility of matter has for the most part been supported upon different grounds, and philosophers have involved themselves in the same fatal consequences, by a much shorter process of reasoning. No compound or visible bodies, it is well known, ever come into immediate contact with each other, or influence each other by means of simple solidity. The earth is affected by the sun, the moon by the earth; the waters of the earth by the moon. Light is reflected from substances to which it directs its course at a distance, and without impinging upon them. The particles of all bodies deemed the most solid and impermeable, are capable of approaching nearer, or receding farther from each other, by an application of different degrees of cold or heat. We can, hence, it is said, form no conception of perfect solidity; and every phænomenon in nature appears to disprove its existence. The minutest corpuscle we can operate upon is still capable of a minuter division, and the parts into which it divides possessing the common nature of the corpuscle which has produced them, must necessarily, it is added, be capable of a still farther division; and as such divisions can have no assignable limit, matter must necessarily and essentially be divisible to infinity.

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* Book viii.

† Book x. p. 443. 4to. 1776.

Such was the reasoning of Des Cartes, and of the numerous host of philosophers who attached themselves to his theory about the middle of the seventeenth century. The argument, indeed, is highly plausible; but it was soon obvious, that, like the Grecian incorporiety of matter, it leads to a pure nonentity of a material world: for that which is essentially unsolid and infinitely divisible, must at length terminate in nothing. And hence, Leibnitz attempted to amend the system, about half a century, and Boscovich, about a century afterwards, by contending, as indeed Zeno is supposed to have done formerly, that matter has its ultimate atoms, or monads, as they were denominated by Leibnitz, from the language of Pythagoras, beyond which it is altogether indivisible; and that these ultimate atoms or monads are simple inextended points, producing, however, the phænomenon of extension, by their combination, and essentially possest of the powers of attraction and repulsion.

There is such a charm in novelty, that it often leads us captive in despite of the most glaring errors, and intoxicates our judgment as fatally as the cup of Circe. It is upon this ground alone we can account for the general adoption of this new system, when first proposed in its finished state by Boscovich, and the general belief that the Gordian knot was at length fairly untied, and every difficulty overcome. It required a period of some years for the heated imagination to become sufficiently cool to enable mankind to see, as every one sees at present, that the difficulties chargeable upon the doctrine of an infinite divisibility of matter are not touched by the present theory, and remain in as full force as before its appearance. If the monads, or ultimate points of matter here adverted to, possess body, they must be as capable of extension, and consequently of division, as material body under any other dimension or modification: if they do not possess body, then they are as much nonentities as the primal or amorphous matter of Plato or Pythagoras. Again, we are told that these points or monads are endowed with certain powers; as those, for example, of attraction and repulsion. But powers must be the powers of something; what is this something to which these powers are thus said to appertain? if the ultimate and inextended points before us have nothing but these powers, and be nothing but these powers, then are such powers powers of nothing, powers without a substrate, and, consequently, as much nonentities as on the preceding argument. Visible or sensible matter, moreover, it is admitted by M. Boscovich and his disciples, is possessed of extension; but visible or sensible matter is also admitted to be a mere result of a combination of inextended atoms:—how can extension proceed from what is inextended?—of two diametrical opposites, how is it possible that either can become the product of the other?

It is unnecessary to pursue this refutation. The lesson which the whole of such fine-spun and fanciful hypotheses teach us, and teach us equally, is, that it is impossible to philosophize without a firm basis of first principles. We must have them in physics as well as in metaphysics,—in matter as well as in morals; and hence the best physical schools in Greece, as well as in more modern times,—those which have contended for the eternity of matter, as well as those which have contended for its creation out of nothing,—have equally found it necessary to take for granted, what in fact can never be proved, that matter in its lowest and ultimate parts consists of solid, impenetrable, and moveable particles, of definite sizes, figures, and proportions to space; from different combinations of which, though invisible in themselves, every visible substance is produced.

This theory, which has been commonly distinguished by the name of the Atomic philosophy, was first started in Greece by Leucippus or Democritus, and afterwards considerably improved by Epicurus; and as it bears a striking analogy to many of the features which mark the best opinions of the present day, and has probably given them much of their colour and complexion, if it have not originated them, I shall take leave to submit to you the following outline of it:—*

The Atomic philosophy of Epicurus, in its mere *physical* contemplation, allows of nothing but matter and space, which are equally infinite and unbounded, which have equally existed from all eternity, and from different combinations of which every visible form is created. These elementary principles have no common property with each other: for whatever matter is, that space is the reverse of; and whatever space is, matter is the contrary to. The actually solid parts of all bodies, therefore, are matter; their actual pores space; and the parts which are not altogether solid, but an intermixture of solidity and pore, are space and matter combined. Anterior to the formation of the universe, space and matter existed uncombined, or in their pure and elementary state. Space, in its elementary state, is absolute and perfect void; matter, in its elementary state, consists of inconceivably minute seeds or atoms, so small that the corpuscles of vapour, light, and heat are compounds of them; and so solid, that they cannot possibly be broken or abraded by any concussion or violence whatever. The express figure of these primary atoms is various: there are round, square, pointed, jagged, as well as many other shapes. These shapes, however, are not diversified to infinity; but the atoms themselves of each existent shape are infinite or innumerable. Every atom is possessed of certain intrinsic powers of motion. Under the old school of Democritus, the perpetual motions hence produced were of two kinds: a descending motion, from the natural gravity of the atoms; and a rebounding motion, from collision and mutual clash. Besides these two motions, and to explain certain phænomena to which they did not appear competent, and which were not accounted for under the old system, Epicurus supposed that some atoms were occasionally possessed of a third, by which, in some very small degree, they descended in an oblique or curvilinear direction, deviating from the common and right line anomalously; and in this respect resembling the oscillations of the magnetic needle.

These infinite groups of atoms, flying through all time and space in different directions, and under different laws, have interchangeably tried and exhibited every possible mode of rencounter; sometimes repelled from each other by concussion, and sometimes adhering to each other from their own jagged or pointed construction, or from the casual interstices which two or more connected atoms must produce, and which may be just adapted to those of other figures, as globular, oval, or square. Hence the origin of compound and visible bodies; hence the origin of large masses of matter; hence, eventually, the origin of the world itself. When these primary atoms are closely compacted, and but little vacuity or space lies between, they produce those kinds of substances which we denominate solid, as stones and metals; when they are loose and disjoined, and a large quantity of space or vacuity is interposed, they exhibit bodies of lax texture, as wool, water, vapour. In one mode of combination, they form earth; in another, air; and in another, fire. Arranged in one way, they produce vegetation and irritability; in another way, animal life and perception. Man hence arises, families are formed, societies are multiplied, and governments are instituted.

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* This outline is given more at length in the author's Prolegomena to his translation of "The Nature of Things," p. cix. and following.

The world, thus generated, is perpetually sustained by the application of fresh tides of elementary atoms, flying with inconceivable rapidity through all the infinity of space, invisible from their minuteness, and occupying the posts of those that are as perpetually flying off. Yet nothing is eternal or immutable but these elementary seeds or atoms themselves. The compound forms of matter are continually decomposing and dissolving into their original corpuscles; to this there is no exception: minerals, vegetables, and animals, in this respect all alike, when they lose their present make, perishing for ever, and new combinations proceeding from the matter into which they dissolve. But the world itself is a compound though not an organized being; sustained and nourished, like organized beings, from the material pabulum that floats through the void of infinity. The world itself must, therefore, in the same manner, perish: it had a beginning, and it will have an end. Its present crasis will be decompounded; it will return to its original, its elementary atoms; and new worlds will arise from its destruction.

Space is infinite, material atoms are infinite, but the world is not infinite. This, then, is not the only world, nor the only material system that exists. The cause that has produced this visible system is competent to produce others: it has been acting perpetually from all eternity; and there are other worlds, and other systems of worlds, existing around us.

Those who are acquainted with the writings of Sir Isaac Newton and Mr. Locke will perceive in this sketch of the Atomic philosophy the rudiments of a very great part of their own systems, so far as relates to physics; we may, indeed, fairly regard them as offsets from the theory before us, cleared in a very great degree of its errors, and enlarged in their principles, and fortified by more recent observations and discoveries. I must, for the present, confine myself to the following quotations from the first of these high ornaments of our country. "All things considered," says Sir Isaac, "it seems probable that God, in the beginning, formed matter in *solid*, *massy*, *hard*, *impenetrable*, *moveable particles*; *of such sizes and figures*, and with such *other properties*, and in such *proportion to space*, as most conduced to the end for which he formed them." So again: "While the primitive and solid particles of matter continue entire, they may compose bodies of one and the same nature and texture in all ages; but should they wear away, or break in pieces, the nature of things depending on them would be changed. Water and earth, composed of old worn particles and fragments of particles, would not be of the same nature and texture now, with water and earth composed of entire particles at the beginning; and therefore, that nature may be lasting, the changes of corporeal things are to be placed only in the *various separations*, and *new associations* and *motions* of these permanent particles: compound bodies being apt to break, not in the midst of solid particles, but where those particles are laid together, and touch only in a few points."

The Epicurean doctrine, moreover, of a flux and reflux of elementary particles exterior to every material system, perpetually feeding and replenishing it, and carrying off its dissolved and rejected rudiments, bears no small resemblance to the ethereal medium of Sir Isaac Newton ; and, in its law of action, has been singularly revived within the course of the last six years by Professor Leslie, in his principles of impulsion, as detailed in his "Inquiry into the Nature of Heat." (It is a doctrine, also, peculiarly coincident with Dr. Herschel's recent theory of nebulæ, or milky ways in the heavens, which, contrary to his own earlier opinions, and those of former astronomers, who ascribed such appearance to the mixed light thrown forth from clusters of stars too remote to be reached by the best telescopes, he now resolves, as we shall have occasion to show more minutely in due time, into masses of a luminous fluid, existing independently of all stars or planets, though originally, perhaps, emitted from them ; aggregated by a variety of causes that tend to give its minute particles unity ; sometimes forming new stars by its condensation, and often feeding and regenerating those that are exhausted.)

Such is a brief survey of the chief theories of the primitive or elementary substance of matter which have been offered in ancient or modern times ; from a combination of the different particles of which, in different modes and proportions, and under the operation of different laws, all sensible bodies are supposed to have proceeded.

Of sensible bodies thus produced, some, however, in direct repugnancy to the Atomic philosophy, whether of ancient or more recent times, have been very generally conceived to have been formed first; to be peculiarly simple in their composition, indecomposable by any known powers in their structure, and to be the basis of all other bodies, or those from which all other bodies proceed, by different unions and modifications : and hence such substances have been denominated *constituent principles*, or *constituent elements;* concerning the kind and number of which, however, we have had almost as many opinions offered as concerning the origin and nature of the primitive principles themselves.

Thus, among both the ancients and the moderns, sometimes fire, sometimes air, sometimes earth, and sometimes water, has been considered as the sole constituent element or source of things. Sometimes two of these substances have been thus denominated, and sometimes three ; but more generally the whole. Occasionally, indeed, a fifth, and even a sixth, have been added to the number, as cold and oil, each of these having at times been considered as simple and indecomposable substances : while, under the old Atomic system, and especially as improved by Epicurus, all such principles were completely swept away, and no one sensible substance whatever was conceived to be better entitled to the character of a constituent principle than another; the whole equally flowing from peculiar modifications and combinations of the primitive or elementary principles—the RERUM PRIMORDIA—and equally resolving into them upon decomposition.

Of these different theories, the greater number are scarcely worth examining ; and I shall only therefore observe, that for that which supposes the existence of four distinct elements, fire, air, earth, and water, and which for ages has been in almost universal acceptation, and would have been so still but for the recent discoveries of chemistry, we are indebted to Empedocles. This celebrated philosopher, and very excellent poet, flourished about four centuries before the Christian æra. His opinions, like those of almost all the earliest sages, were given in metre, in a didactic poem, "On Nature," of which only a few fragments have descended to our own times. He was a native of Sicily, and his talents and his country are celebrated by Lucretius, who was nevertheless of a very different school of philosophy, in verses so elegant and so descriptive, that I cannot refrain from presenting you with a literal but very humble translation of them; introduced, more especially as they are, with observations upon different rival philosophers, who employed one, two, and various other numbers of the commonly esteemed elements, and in various combinations, as the basis of their respective theories.

> Nor wanders less the sage who AIR with FIRE
> Would fain commix, or limpid STREAM with EARTH;
> Or those the whole who join, FIRE, ETHER, EARTH,
> And pregnant SHOWERS, and thence the world deduce.
> Thus sung EMPEDOCLES, in honest fame
> First of his sect; whom AGRIGENTUM bore
> In cloud-capt SICILY. Its sinuous shores
> Th' IONIAN main, with hoarse, unwearied wave,
> Surrounds, and sprinkles with its briny dew:
> And, from the fair ÆOLIAN fields, divides
> With narrow frith that spurns th' impetuous surge.
> Here vast CHARYBDIS raves: here ÆTNA rears
> His infant thunders, his dread jaws unlocks,
> And heav'n and earth with fiery ruin threats.
> Here many a wonder, many a scene sublime,
> As on he journeys, checks the traveller's steps;
> And shows, at once, a land in harvest rich,
> And rich in sages of illustrious fame.
> But naught so wond'rous, so illustrious naught,
> So fair, so pure, so lovely, can it boast,
> EMPEDOCLES, as thou! whose song divine,
> By all rehears'd, so clears each mystic lore,
> That scarce mankind believ'd thee born of man.
> Yet e'en EMPEDOCLES, and those above
> Already sung, of far inferior fame,
> Though doctrines frequent from their bosoms flow'd
> Like inspiration, sager and more true
> Than e'er the PYTHIAN maid, with laurels crown'd,
> Spoke from the tripod at APOLLO'S shrine;
> E'en those mistook the principles of things,
> And greatly wander'd in attempt so great.

Let our controvertists of the present day learn a lesson of liberality from this correct and polished reasoner, whose own theory is well known to have been that of Epicurus, to which I have just adverted, namely, that one substance is just as much entitled to the character of a constituent element as another,—and that every thing equally proceeds from and in turn is resolved into the primitive and invisible atoms or principles of matter.

It is to this theory alone that all the experiments of modern chemistry are giving countenance. Air, water, and earth suspected to be compounds in the time of Epicurus, have been proved to be such in our own day; while of the actual nature of heat or fire, mankind are just as uninformed now as they were then.

In the process, however, of destroying these supposed elements, chemistry has occasionally seemed to detect others; and hence, instead of air, fire, earth, and water, as simple or indecomposable substances, we have had phlogiston, acids, and alkalies; sulphur and phosphorus; oxygene, hydrogene, nitrogene, and carbon, progressively arising before us, and laying claim to an imperishable existence. All of them, however, have fallen, or are falling in their turn, without having lived long enough to reach the common age of man; all of them have been proved, or reasonably suspected, to be compounds of other substances, that may yet, perhaps, be detected to be compounds of something beyond. Even oxygene, the most brilliant of the whole, the boasted discovery of Lavoisier, and out of which he was supposed to have built to his own memory "a monument more durable than brass," has had its throne shaken to its foundation by Sir Humphry Davy, and is at this moment, like the Roman empire in its decline, obliged to divide its sway with a new and popular power, which this last celebrated chemist has denominated chlorine; while of the more subtle and active agents, light, caloric, the magnetic and electric fluids, we know nothing but from their effects, and can only say of each—*stat nominis umbra.*

Is physical science then a vain show?—a mere house of cards, built up for the sole purpose of being pulled down again?—Assuredly not. The firm footing we have actually obtained upon many essential points—a footing not to be disturbed by any future change of system, or novelty of discovery—and the ascertainment of a multitude of recondite facts, and their application to some of our most extensive and valuable arts, sufficiently prove that philosophy has neither lived nor laboured in vain. Although we have not been able to break through the spell completely—to follow up the Proteus-form of matter into its deepest recesses, and fix it in its last shape and character—we have succeeded in developing many of its most important laws, as it will be the object of the ensuing lecture to point out, and to apply them to a solution of many of its most important phænomena. Whatever is sure and trusty has remained to us, and whatever has given way has been mere chimera and shadow: we have chiefly, perhaps only, failed where we have either been too curious, or have suffered imagination to become our charioteer in the slow and sober journey of analysis.

Before we quit this subject, let us, in the candid spirit of genuine philosophy, do the same justice to Epicurus as we attempted in our last lecture to Pythagoras and Plato. It has been very generally said, and very generally believed, principally, because it has been very generally said, that the great and mighty cause of this beautiful and harmonious formation of worlds, and systems of worlds, in the opinion of Epicurus, was mere CHANCE, OR FORTUNE. There is nothing, however, in those fragments of his works which have descended to us, that can in any way countenance so opprobrious an opinion, but various passages that distinctly controvert it,—passages in which he peremptorily denies the existence of CHANCE OR FORTUNE, either as a deity or a cause of action; and unequivocally refers the whole of those complex series of percussions and repercussions, interchanges and combinations, exhibited by the elementary seeds or atoms of matter during the creative process, to a chain of immutable laws which they received from the Almighty Architect at the beginning, and which they still punctually obey, and will for ever obey till the universe shall at length cease to exist.* "Whom," says Epicurus, in a letter to his disciple Menæceus, that has yet survived the preying tooth of time, and will be found in Diogenes Laertius, "do you believe to be more excellent than he who piously reveres the Gods, who feels no dread of death, and rightly estimates the design of nature? Such a man does not, with the multitude, regard CHANCE as a God, for he knows that God *can never act at random:* nor as A CONTINGENT CAUSE OF EVENTS ; nor does he conceive, that from any such power flows the good or the evil that measures the real happiness of human life." He held, however, that the laws which govern the universe were altogether arranged and imposed upon it by the Creator at its first formation, and that the successive train of events to which they have given rise have followed as the necessary result of such an arrangement, and not as the immediate superintendence of a perpetually controlling Providence. For it was the opinion of Epicurus, as well as of Aristotle, that perfect rest and tranquillity are essential to the perfect happiness even of Him, who, to adopt his own language in another place, possesses all immortality and beatitude. "Think not," says he, "that the different motions, and revolutions of the heavens, the rising, setting, eclipses, and other phænomena of the planets, are produced by the *immediate* control, superintendence, or ministration of Him who possesses all immortality and beatitude? it is from the immutable laws which they received at the beginning, in the creation of the universe, that they punctually fulfil their several circuits."

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* **For a more extensive inquiry into this subject, the reader is referred to the author's Prolegomena to his translation of the "Nature of Things," from which this summary is drawn.**

The origin of this calumny upon the character of Epicurus it is by no means difficult to trace, and it has been sufficiently traced, and sufficiently exposed, by Diogenes Laertius, Gassendi, Du Rondelle, and other distinguished writers, who have done ample justice to his memory; and upon the confessions of Plutarch, Cicero, and Seneca, abundantly proved, that it was the same rancorous spirit of envy among many of his competitors for public fame, and especially among the Stoic philosophers, which strove to fix upon him the charge of voluptuous living, though the most temperate and abstemious Athenian of his day, that thus, with yet keener malevolence, endeavoured to brand him with the still fouler reproach of the grossest impiety and atheism. It is indeed scarcely to be believed, if the fact were not concurrently attested by all the writers of antiquity, that the philosopher, whose name, from the low and malignant spirit I have just adverted to, has been proverbialized for general licentiousness and excess, drew the whole of his daily diet from the plainest pottage, intermixed with the herbs and fruits of his pleasant and celebrated garden. "I am perfectly contented," says he, in an epistle to another friend, "with bread and water alone; but send me a piece of your Cyprian cheese, that I may indulge myself whenever I feel disposed for a luxurious treat." Such, too, was the diet of his disciples. Water, says Diocles, was their common beverage; and of wine they never allowed themselves more than a very small cup. And hence, when the city of Athens was besieged by Demetrius, and its inhabitants reduced to the utmost extremity, the scholars of Epicurus bore up under the calamity with less inconvenience than any other class of citizens; the philosopher supporting them at his own expense, and sharing with them daily a small ration of his beans. The pleasure of friendship, the pleasure of virtue, the pleasure of tranquillity, the pleasure of science, the pleasure of gardening, the pleasure of studying the works of nature, and of admiring her in all the picturesque beauty of her evolutions, formed the sole pursuit of his life. This alone, he affirmed, deserves the name of PLEASURE, and can alone raise the mind above the grovelling and misnamed pleasures of self-indulgence, debauchery, and excess.

There is something gratifying to an enlarged and liberal spirit in being thus able to rescue from popular, but unfounded obloquy, a sage of transcendent genius and almost unrivalled intellect, and in restoring him to the admiration of the virtuous and the excellent. That he did not feel the force of any argument offered by nature in proof of the immortality of the soul, and was in this respect considerably below the standard of Socrates and Cicero, must be equally admitted and lamented; and should teach us the high value of that full and satisfactory light which was then so much wanted, and has since been so gloriously shed upon this momentous subject. But let it at the same time be remembered, that, with a far bolder front than either of the philosophers here adverted to, he dared to expose the grossness and the absurdities of the popular religion of his day, and in his life and his doctrines gave a perpetual rebuke to vice and immorality of every kind. And hence, indeed, the main ground of the popular calumny with which his character was attacked, and which has too generally accompanied his memory to the present day.

LECTURE IV.

ON THE PROPERTIES OF MATTER, ESSENTIAL AND PECULIAR.

In our last lecture I endeavoured to render it probable, that all visible or sensible matter is the result of a combination of various solid, impenetrable, and exquisitely fine particles or units of the same substance, too minute to be detected by any operation of the senses. Of the shape or magnitude of these particles we know nothing: and even their solidity and impenetrability, as I then observed, is rather an assumption, for the purpose of avoiding several striking difficulties and absurdities that follow from a denial of these qualities, than an ascertained and established fact.

From this unsatisfactory view of it in its elementary and impalpable state, let us now proceed to contemplate it in its manifest and combined forms, and to investigate the more obvious properties they offer, and the general laws by which they are regulated.

The change of distance between one material body and another, or, in other words, their approach to our separation from each other, is called MOTION; and the wide expanse in which motion of any kind is performed is denominated SPACE.

Matter has its ESSENTIAL, and its PECULIAR PROPERTIES. Its essential properties are those which are common to it under every form or mode of combination. Its peculiar properties are those which only appertain to it under definite forms or definite circumstances.

The ESSENTIAL PROPERTIES of matter are usually classed under the six following heads: passivity, extension, density, impenetrability, divisibility, and gravitation; which, however, may easily be reduced to four, since extension, density, and impenetrability may be comprehended under the general term of cohesibility.

PASSIVITY, *inertia*, or *vis inertiæ*, is the tendency in a body to persevere in a given state, whether of rest or motion, till disturbed by a body of superior force. And hence these terms, which are mere synonyms, imply a power of mobility as well as a power of quiescence; although passivity has often been confined to quiescence, while mobility has been made a distinct property. Thus it is from the same power or tendency to passivity, that a cannon ball continues its motion after being projected from a gun, as that by which it remained at rest before it was thrown off; for it is a well-known theorem in projectiles, that the action of the powder on a bullet ceases as soon as the bullet is out of the piece. In like manner a billiard-ball at rest will continue so till put into motion by a billiard-ball in motion, for it can never commence motion of its own accord. While a billiard-ball in motion would persevere in motion, and in the same velocity of motion, for ever, if it met with no resistance. But it does meet with resistance from a variety of causes, as the friction of the atmosphere, the friction of the green cloth, and at last a contact with one of the sides of the table, or with the ball against which it is directed.

In this last case either ball will receive conversely the same precise proportion of rest or motion which it communicates. Thus, if the ball in motion strike the ball at rest obliquely, the latter will be put into a certain degree of activity, and the former will, in the very same degree, be impeded in its progress, and receive an equal tendency to a state of rest. If the latter, on the contrary, by what is significantly called a *dead* stroke, receive the whole charge of motion which belongs to the former, it will give to the former, in like manner, the whole possession of its quiescence, and the state of each will be completely reversed; the ball hitherto at rest proceeding with all the velocity of that hitherto in motion, and the ball hitherto in motion exhibiting the dead stand of that hitherto at rest.

So, if it were possible to place an orb quietly in some particular part of space, where it would be equally free from the attractive influence of every one of the celestial systems, it would, from the same tendency to inertitude, remain quiescent, and at rest for ever. While, on the contrary, if a body were to be thrown from any one of the planets by the projectile force of a volcano, or of any other agency, beyond the range of the attractive or centripetal power of such planet, it would continue the same velocity of motion for ever which it possessed at the moment of quitting the extreme limit of the planet's influence; unless in its progress it should encounter the influence of some other planet; and in this last case it would be either drawn directly into contact with the planet it thus casually approached, or would have its path inflected into a circle, and revolve around it as a satellite, according to its velocity, and the relative direction of its course at the moment the planetary influence began to take effect. Thus a body projected horizontally to the distance of about 4.35 miles from the earth's surface, provided there were no resistance in the atmosphere, would not fall back again, but become a satellite to the earth, and perpetually revolve around it at this distance. The moon is supposed to have no atmosphere, or, at the utmost, one rarer than we can produce with our best air-pumps: she is also supposed to possess larger and more active volcanos than any which are known to exist on the earth. And hence it requires no great stretch of imagination to conceive that bodies may occasionally be thrown from the moon, by the projectile power of such volcanos, to such a distance as that they should never return to her surface: for if the momentum be only sufficient to cause the mass ejected to proceed at the rate of about 8,200 feet in the first second of time,* and in a line passing through the moon and the earth, such effect would necessarily be produced; since, in this case, the propelled mass would quit the centripetal power of the former, and be drawn into that of the latter, and would either become a satellite to the earth, or be precipitated to its surface, according as the rectilinear force of the projectile was equal or inferior to the attractive force of the earth at their first meeting together.

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* Laplace, Exposition du Systeme du Monde.

Yet this is, perhaps, but little more than the velocity with which a twenty-four pound cannon-ball would travel from the moon's surface: since its velocity on the earth's surface may be calculated at about 2,000 feet for the first second; and it would rush nearly four times as rapidly if not impeded by the resistance of the atmosphere. And hence it is to this cause that M. Olbers first, and M. Laplace has since, ascribed the origin of those wonderful aerolites, or stones, that are now known to have fallen from the air at some period or other in every quarter of the globe; believing them to be in every instance volcanic productions of the moon, thrown by the impulse of the explosion beyond the range of her centripetal influence.

Cohesibility is the tendency which one part of matter evinces to unite with another part of matter, so as to form out of different bodies one common mass. It includes the three modes, which have often been regarded as three distinct properties, of *extension*, *density*, and *impenetrability*. Extension is a term as applicable to space as to matter: "The extension of body," observes Mr. Locke, "being nothing but the cohesion or continuity of solid, separable, moveable parts; and the extension of space the continuity of unsolid, inseparable, and immoveable parts." Hence extension applies to all directions of matter, for its continuity may take place in all directions; but in common language the longest extension of a body is called its length, the next its breadth, and the shortest its thickness.

Density is a property in matter to cohere with a closer degree of approximation between the different particles of which it consists; so that the same body, when in the exercise of this property, occupies a smaller portion of space than before it was called into act. Hence density cannot be a property of space, the parts of which, as I have just observed, are immoveable, and cannot, therefore, either approach or recede.

Impenetrability is the result of density, as density is of extension. It is that property in matter which prevents two bodies from occupying the same place at the same time. They are all branches of the common property of cohesibility. A wedge of iron, indeed, may force its way through the solid fibres of the trunk of a tree; but it can only do this by separting them from each other: it cannot penetrate the matter of which those fibres consist. In like manner, when a ship is launched, her hulk cannot sink into the water without displacing the exact bulk of water which existed in the space that the hulk below the surface now occupies.

To a cursory survey, however, there are some phænomena that seem to show that certain bodies are penetrable by others. Thus, if a cubic inch of water be mixed with a cubic inch of spirit of wine or sulphuric acid, the bulk of the compound will be something less than two cubic inches. But in this case, one of the fluids appears to admit a part of the other fluid into its pores; a fact of which there can be little doubt, since, if no evaporation be allowed to take place, though the bulk of the mixture is somewhat diminished, its weight is precisely equal to what it ought to be. The combination of different metals affords, not unfrequently, similar instances of equal introsusception.

Divisibility is a power in matter directly opposed to its cohesibility. It is that property of a body by which it is capacified for separating into parts, the union or continuity of which constituted its extension.

Divisibility, however, does not destroy cohesion in every instance equally; though the farther it proceeds the farther it loosens it. We are told by Mr. Boyle, that two grains and a half of silk, were, on one occasion, spun into a thread not less than three hundred yards long, which is, notwithstanding, a much shorter length than the spider is capable of spinning his web of the same weight. Muschenbroek mentions an artist of Nuremburg, who drew gold wire so fine that 500 inches of it only weighed one grain; and Dr. Wollaston has obtained platinum wire as fine as $\frac{1}{30000}$th of an inch.* The thickness of tin-foil is about a thousandth part of an inch;† that of gold-leaf is less than a two hundred thousandth part of an inch; and the gilding of lace is still thinner, probably in some cases not more than a millionth part of an inch; and there are living beings, visible to the microscope, of which a million million would not make up the bulk of a common grain of sand. Yet it is highly probable, from what has actually been ascertained of the anatomy of minute and microscopic animals, that many of these are as complicated in their structure as the elephant or the whale.

Gravitation is the common basis upon which all the preceding properties are built, except passivity; the great principle into which all the rest resolve themselves. Gravitation is the attraction by which bodies of all kinds act upon each other, with a force regulated by the aggregate proportion of their respective quantities of matter, and decreasing as the squares of the distances increase. It is a law impressed on matter universally, and hence operates alike on the minutest and on the largest masses; produces what we call weight on earth, or the tendency of heavy bodies to fall towards the earth's centre; and governs the revolutions of the planets. The five principles which regulate its mode of action, and constitute its magnificent code of laws, are thus summed up by M. La Place.‡

1. Gravitation takes place between the most minute particles of bodies.
2. It is proportional to their masses.
3. It is inversely as the squares of the distances.
4. It is transmitted instantaneously from one body to another.
5. It acts equally on bodies in a state of rest, and upon those which, moving within its range, seem to be flying off from its power.

To a casual observer there are many substances that seem to fly away from the earth, and consequently to oppose this general law. Thus smoke, when extricated from burning bodies, and vapour, when separated from liquids, ascend into the atmosphere; and a piece of cork, plunged to the bottom of a vessel of water, rises rapidly to the surface. But, in all these phænomena, the bodies that seem to move upwards merely give way to bodies of a heavier kind, or, in other words, which have a stronger tendency towards the earth. Thus smoke and vapour only ascend, because the surrounding air, which is heavier than these, presses downwards and takes their place; and the cork rises because lighter than the water into which it has been plunged: but empty the vessel, and the cork will remain at the bottom, because heavier than the surrounding air: and let the smoke or the vapour be received into a vacuum, and it will remain as much at the bottom as the cork.

It was first systematically demonstrated by Sir Isaac Newton, that all the motions of all the heavenly bodies depend upon the same power; and the principle thus struck out has of later years been still more extensively and even more accurately applied to a solution of the most complicated phænomena. This principle in astronomy is denominated the centripetal force, and the term is sufficiently precise for all common purposes; since, although, speaking with perfect strictness, the central point of no solid substance is the actual spot in which its attractive power is chiefly lodged, yet it has been abundantly proved by Sir Isaac, that all the matter of a spherical body, or a spherical surface, may, in generally estimating its attractive force on other matter, be considered as collected in the centre of such sphere. And hence, as all the celestial bodies are nearly spherical, their action on bodies at a distance may be held the same as if the whole of the matter of which they consist were condensed into their respective centres.

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* Wollaston in Phil. Trans. for 1813, p. 114. Thomson's Annals of Philos. No. III. p. 224.

† Davy's Elem. vol. i. p. 379.

‡ Exposition du Systeme du Monde.

To what extent in the heavens the power of gravitation ranges it is impossible to determine; there can be little doubt, however, that it extends from one fixed star to another, although its effects are too inconsiderable to be calculated by man. It may possibly influence the progressive motion of several of the stars, and, as I had occasion to observe in a preceding lecture, is the cause to which Dr. Herschel ascribes the origin of the material universe, which he supposed at one time, though he seems afterwards to have modified his opinion, as we shall notice in our next study, to have issued from an immense central mass of matter, peculiarly volcanic in its structure, and to have been, consequently, thrown forth in different quantities, and at different times, by enormous explosions; each distinct mass, thus forcibly propelled, assuming, from the common law of projectiles, an orbicular path, and endowed with the common property of the parent body, ejecting in like manner minuter masses at different periods of time, which have equally assumed the same orbicular motion, and ultimately become planets to the body from which they have immediately issued, and which constitutes their central sun.

To produce such an effect, however, and in reality to produce any of the motions which occur to us in the celestial bodies, the PASSIVITY of matter is just as necessary as its gravitation. I have already observed that, owing to its passivity, or VIS INERTIÆ, matter has a tendency to persevere in any given state, whether of motion or of rest, till opposed by some exterior power; and that the path it assumes must necessarily be that of a right line, unless the power it encounters shall bend it into a different direction. A projectile, therefore, as a planet, for example, thrown forth from a volcano, would travel in a right line for ever, and with the exact velocity with which it was thrown forth at first, if there were nothing to impede its progress, or to alter the course at first given to it. But the attraction of the volcanic sphere from which it has been launched does impede it, and equally so from every point of its surface: the consequence of which must necessarily be, that every step it advances over the parent orb it must be equally drawn back or reined in, and hence its rectilinear path must be converted into a curve or parabola, and a tendency be given to it to escape in this line, which may be contemplated as a line of perpetual angles, instead of in a direct course; and as soon as the projectile or planet has acquired the exact point in which the two antagonist powers precisely balance each other—the power of flying off from the centre, communicated to it by the volcanic impulsion, and which is denominated its CENTRIFUGAL FORCE, and the power of falling forward to the centre, communicated by the attractive influence of the aggregate mass of matter which the parent sphere contains in itself, and which is called its CENTRIPETAL FORCE —it will have reached its proper orbit; and, through the influence of this constant antagonism of the two properties of passivity and gravitation, of a centrifugal and centripetal force, persevere in the same to the end of time.

Of the immediate cause of gravitation, or the nature of that power which impels different bodies to an union, we are in a very considerable degree of ignorance; or rather, perhaps, may be said to know nothing at all. It is necessary, however, to notice one very singular phænomenon concerning it, and to give a glance at two out of various theories, by which gravitation has been attempted to be accounted for.

The phænomenon is, that although, owing to this power, all bodies have a tendency to come into contact, they never come into actual contact; some kind of pore or open space being still left between the corpuscles of bodies that approach the nearest to each other. Thus, a plate of heated iron, solid as it appears to be, and altogether destitute of pores, becomes contracted in every direction by cold. So, too, as I have already observed, equal measures of water and alkohol, or of water and sulphuric acid, have their bulk sensibly diminished. In like manner, Newton has remarked, that when two plates of glass are within about a ten thousandth part of an inch of each other, using fine metallic plates as a micrometer on this occasion, they support each other's weight as powerfully as if they were in actual contact, and that some additional force is requisite in order to make them approach still nearer. Nor is the force necessary to produce this effect of trivial moment; Professor Robison has calculated it, and has ascertained by experiment that it is equal to a pressure of about a thousand pounds for every square inch of glass. Air is not necessary to this resistance, for it is equally manifest in a vacuum; yet it is a very curious fact, that under water it almost entirely disappears. It is, however, highly probable that the contact is never perfect, otherwise the two plates might be expected to cohere in such a manner as to become an individual mass.

It is hence clear that matter, from some cause or other, is possessed of a REPULSIVE as well as of an ATTRACTIVE force; and that, like the latter, although its law has not been hitherto exactly ascertained, it increases in a regular proportion to its decrease of distance, or, in other words, as bodies approximate each other.

It has hence been said, and this is the common theory of those who regard gravitation as an essential property of matter, that matter is universally endowed with two opposite powers; by the one of which material substances attract each other and induce a perfect union, and by the other of which they repel each other when they are on the point of union, and prevent a perfect contact. It is admitted, however, on all hands, and is indeed perfectly clear in itself, that the repulsive power is of an almost infinitely less range than the attractive. I have supposed the attractive power, or that of gravitation, to operate from world to world; yet the repulsive power can never be exerted, except "between such particles as are actually, or very nearly, in contact with each other; since it requires no greater pressure, when acting on a given surface, to retain a gallon of air in the space of half a gallon, than to retain a pint in the space of half a pint, which could not possibly be, if the particles exercised a mutual repulsion at all possible distances.*

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* Dr. Young's Lect. vol. i. p. 612.

This idea, however, of double and opposite powers co-existing in the same substance, and in every corpuscle of the same substance, has been uniformly felt difficult of admission by the best and gravest philosophers; and hence Sir Isaac Newton, while allowing the repulsive power of matter, which in truth is far more obvious to our senses in consequence of its very limited range, has felt a strong propensity to question gravity as forming an essential property of matter itself, and to account for it from another source. "To show," says he, "that I do not take gravity for an essential property of bodies, I have added one question concerning its cause, choosing to propose it by way of question, because I am not yet satisfied about it, for want of experiments."* In this question he suggests the existence of an ethereal and elastic medium pervading all space; and supports his supposition by strong arguments, and consequently with much apparent confidence, deduced from the mediums, or gases, as they are now called, of light and heat, and magnetism, respecting all which, from their extreme subtilty, we can only reason concerning their properties. This elastic medium he conceives to be much rarer within the dense bodies of the sun, the stars, the planets, and the comets, than in the more empty celestial spaces between them, and to grow more and more dense as it recedes from the celestial bodies to still greater distances; by which means all of them, in his opinion, are forced towards each other by the excess of an elastic pressure.

It is possible, undoubtedly, to account for the effects of gravitation by an ethereal medium thus constituted; provided, as it is also necessary to suppose, that the corpuscles of such a medium are repelled by bodies of common matter with a force decreasing, like other repulsive forces, simply as the distances increase. Its density, under these circumstances, would be every where such as to produce the semblance of an attraction, varying like the attraction of gravitation. The hypothesis in connexion with the existence of a repulsive force in common matter has a great advantage in point of simplicity, and may perhaps hereafter be capable of proof, though at present it can only be regarded, and was at first only offered, as an hypothesis.

M. La Place, equally dissatisfied as Sir Isaac Newton with the idea of gravitation being an essential property of matter, passes away from the inquiry with suitable modesty, to practical subjects of far higher importance, and which equally grow out of it, in whatever light it is contemplated. "Is this principle," says he, "a primordial law of nature? or is it a general effect of an unknown cause? Here we are arrested by our ignorance of the nature of the essential properties of matter, and deprived of all hope of answering the question in a satisfactory manner. Instead, then, of forming hypotheses on the subject, let us content ourselves with examining more particularly the manner in which philosophers have made use of this most extraordinary power."†

There is, indeed, one very striking objection to Sir Isaac Newton's suggestion, and which it seems very difficult to repel. It is, that though it may account for the attraction of gravitation, as a phænomenon common to matter in general, it by no means accounts for a variety of particular attractions which are found to take place between particular bodies, or bodies particularly circumstanced; and which, excepting in one or two instances, ought, perhaps, to be contemplated as modifications of gravitation.

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* Optics, pref. to the second edition.

† Exposition du Systeme du Monde, lib. iv. ch. xv.

Upon these particular attractions, or modes of attraction, including homogeneous attraction, or the attraction of aggregation, heterogeneous attraction, or the attraction of capillary bodies, elective attraction, and those of magnetism and electricity, each of which is replete with phænomena of a most interesting and curious nature, I intended to have touched in the present lecture, but our limited hour is so nearly expired, that we must postpone the consideration of them as a study for our next meeting. Yet it is not possible to close the observations which have now been submitted, without testifying our gratitude to the memory of that transcendent genius whom the providence of the adorable Architect of the universe at length gave to mankind six thousand years after its creation, to unravel its irregular confusion, and reduce the apparent intricacy of its laws to that sublime and comprehensive simplicity which is the peerless proof of its divine original.

It has been said, that the discovery of the universal law which binds the pebble to the earth, and the planets to the sun, which connects stars with stars, and operates through infinity, was the result of accident. Nothing can be more untrue, or derogatory to the great discoverer himself. The earliest studies of Newton were the harbinger of his future fame; his mighty mind, that comprehended every thing, was alive to every thing; the little and the great were equally the subjects of his restless researches: and his attention to the fall of the apple was a mere link in the boundless chain of thought, with which he had already been long labouring to measure the phænomena of the universe.

Grounded, beyond all his contemporaries, in the sure principles of mathematics, it was at the age of twenty-two that he first applied the sterling treasure he had collected to a solution of the system of the world. The descent of heavy bodies, which he perceived nearly the same on the summit of the loftiest mountains and on the lowest surface of the earth, suggested to him the idea that gravity might possibly extend to the moon; and that, combined with some projectile motion, it might be the cause of the moon's elliptic orbit round the earth: a suggestion in which he was instantly confirmed by observing, that all bodies in their fall describe curves of some modification or other. And he further conceived, that if the moon were retained in her orbit by her gravity towards the earth, the planets must also in all probability be retained in their several orbits by their gravity towards the sun.

To verify this sublime conjecture, it was necessary to ascertain two new and elaborate positions: to determine the law of the progressive diminution of gravity, and to develope the cause of the curves or ellipses of falling bodies. Both these desiderata he accomplished by a series of reasonings and calculations equally ingenious in their origin and demonstrative in their result; and ascertained the truth of his principles by applying them, practically and alternately, to the phænomena of the heavens, and to a variety of terrestrial bodies.

The bold and beautiful theorem being at length arrived at, and unequivocally established—a theorem equally applicable to the minutest corpuscles, and the hugest aggregations of matter,—that all the particles of matter attract each other directly as their mass, and inversely as the square of their distance, he at once beheld the cause of those perturbations of motion to which the heavenly bodies are necessarily and so perpetually subject; it became manifest, that the planets and comets, reciprocally acting and acted upon, must deviate a little from the laws of that perfect ellipse which they would precisely follow if they had only to obey the action of the sun: it was manifest, that the satellites of the different planets exposed to the complicated action of the sun, and of each other, must evince a similar disturbance: that the corpuscles which composed the different heavenly bodies in their formation, perpetually pressing toward one common centre, must necessarily have produced, in every instance, a spherical mass: that their rotatory motion must at the same time have rendered this spherical figure in some degree imperfect, and have flattened these masses at their poles; and, finally, that the particles of immense beds of water, as the ocean, easily separable as they are from each other, and unequally operated upon by the sun and the moon, must evince such oscillations as the ebbing and flowing of the tides. The origin, progress, and perfection of these splendid conjectures, verifications, and established principles, were communicated in two distinct books, known to every one under the titles of his "Principia" and his "Optics;"—books which, though not actually inspired, fall but little short of inspiration, and have more contributed to exalt the intellect of man, and to display the perfections of the Deity, than any thing upon which inspiration has not placed its direct and awful stamp.

LECTURE V.

ON THE PROPERTIES OF MATTER, ESSENTIAL AND PECULIAR.

(The subject continued.)

We closed our last lecture with remarks on the universal operation of the common principle of gravity over matter in all its visible forms, from the minutest shapes developed by the microscope, to the mightiest suns and constellations in the heavens. But we observed, also, that independently of this universal and essential power of attraction, matter possesses a variety of peculiar attractions dependent upon circumstances of limited influence, and which consequently render such attractions themselves of local extent.

These I will now proceed to notice to you in the following order:—1st, The attraction of *homogeneous* bodies towards each other, which is denominated, in chemical technology, the attraction of aggregation; 2dly, the attraction of *heterogeneous* bodies towards each other, under particular circumstances, which in its more obvious cases is denominated capillary attraction: 3dly, The attraction of bodies exhibiting a peculiar degree of affinity to each other, and which is denominated elective attraction: 4thly, The attraction of the electric fluid; and, 5thly, That of the magnetic.

I. The law of physics which has rendered every material substance capable of attracting and being attracted by every other material substance seems at the same time to have produced this power in a much stronger degree between SUBSTANCES OF LIKE NATURES. Thus, drops of water placed upon a plate of dry glass have a tendency to unite, not only when they touch, but when in a state of vicinity to each other; and globules of quicksilver still more so: and it is this kind of attraction which is called the attraction of aggregation. And in both these cases the attraction in question evinces a considerable superiority of force to the general attraction of gravitation; since the particles of the drops or globules ascend from the surface of the glass, except those that form their narrow base, and are drawn towards their proper centres, instead of being drawn towards the centre of the earth.

If, however, the convex shape of the drop of water be destroyed by pressing it over the glass into a thin extended film, the general attraction of gravitation, acting with increased effect upon an increased space, will overpower the individual attraction of aggregation, and the particles of water will be restrained from attempting a spherical figure as before. In the quicksilver, nevertheless, the attraction of aggregation being much stronger than in the water, it will still continue to prevail; and it is only by a very minute and elaborate division of the particles of this material that we can give to the attraction of gravitation a predominancy.

The same result occurs in the homogeneous particles of oil. And hence, if we divide its particles by shaking a certain portion of it in water, we find, upon giving the mixture rest, that the water will first sink to the bottom, or, which is the same thing, the particles of the oil will rise to the surface; and then that these particles, as soon as they have reached the range of each other's attraction, will unite into one common body.

Now, in all these cases it is obvious that the particles of matter thus obeying the law of homogeneous attraction assume or attempt to assume a spherical figure; and we not unfrequently perceive a similar attempt, even where the breadth of the surface, and the consequent potency of the attraction of gravitation, would hardly induce us to expect that there could be the least effort towards it; as, for example, in a glass brim-full, or somewhat more than brim-full of wine, or any other liquid.

We behold the same figure in the drops of rain as they descend from the clouds; a figure which, in fact, is the sole cause of the vaulted form of the rainbow, as I may possibly take leave to explain more particularly on some future occasion. We behold it in reality throughout all nature, in every substance whose particles are capable of uniting and separating with ease; and, consequently, of readily obeying the laws of cohesibility and divisibility as those of liquids; and we should see it equally in solids, but that the particles of these last are incapable of doing readily either the one or the other.

What, then, is the general cause that produces so general an effect? Clearly this; a cause to which I have already in some degree adverted, in speaking of the general attraction of gravitation: that, there being an equal tendency in every particle of homogeneous bodies to press together, they must press equally towards one common centre, and strive to be as little remote from that centre as possible. Such a strife, however, must necessarily produce a globular or spherical form; for it is in such a form only that the extreme particles, or those constituting its surface, and which are prevented from a closer approach by those that lie within, are equally near and equally remote in every direction.

Hence, then, the cause of the globular figure of drops of quicksilver, drops of water, drops of rain, and drops of dew, collected and suspended from the fresh leaves of plants in the balmy air of the morning; and hence one reason, though there is also another that concurs with it, and which I shall explain presently, for the convex shape assumed by a wine-glass of liquid of any kind, on its surface, when brim-full, or somewhat more.

The same reasoning may be applied to account for the spherical figure of the heavenly bodies; each of which, though probably composed of many different or heterogeneous substances in itself, may be fairly contemplated as a homogeneous mass when compared with those by which it is surrounded ; and hence, too, we see the necessity for their having at first existed, from some cause or other, in a fluid state ; since otherwise, the different corpuscles which enter into their make could not have assumed that symmetrical arrangement which alone gives sphericity to the total bulk.

We have equal proofs of the same peculiar attraction existing between solid bodies, though the proofs are not so common ; since, as I have just observed, the particles of solid bodies have less power of movement, and, consequently, of adaptation to each other, than those of liquids. Thus, two plates of lead, whose opposite surfaces correspond so exactly that every particle of each surface shall have a bearing upon the particle opposed to it, when once united by pressure, assisted by a little friction, cohere so powerfully as to require a very considerable force to separate them. And it may be shown, either by measuring this force, or by suspending the lead in the vacuum of an air-pump, that the pressure of the atmosphere is not materially concerned in producing this effect. A cohesion of this kind is sometimes of practical utility in the arts ; little ornaments of laminated silver remaining attached to iron or steel, with which they have been made to connect themselves by the powerful pressure of a blow, so as to form one mass with it. And it is now a well-known fact, and of a most curious nature, that one of the causes by which eight-day clocks go at times irregularly, and monthly clocks, whose weights are much larger and heavier, often amounting to not less than thirty pounds, stop suddenly, proceeds from the attraction which takes place between their leaden weights and the leaden ball of the pendulum, when the weights have descended just so low as to be on a level, and, consequently, very nearly in a state of contact, with the pendulum-ball. And hence the reason why both these kinds of clocks, if the pendulum have not actually stopped, seem gradually a few days afterwards, to recover their former accuracy ; the attraction diminishing as the distance once more increases.* In like manner, Studor remarks that beams of steel become sometimes erroneous by acquiring magnetic polarity.†

It is by the same means that the greater number of rocks seem to be produced that enter into the substance of the earth's solid crust. The lowermost of these, as I shall have occasion to observe in an ensuing lecture, are united by an intimate crystallization, which is the most perfect form of aggregate or homogeneous attraction that can exist between solid bodies, and which must have commenced while such bodies were in a fluid state. Some of the upper kinds or families are united by a particular cement, which is nothing more than a substance possessing a peculiar attraction, or, if I may be allowed the expression, physical partiality to the rudimental corpuscles of which the rock consists ; and others by nothing more than the law of aggregation or homogeneous attraction in its simplest state ; whence earths unite to earths in consequence of mutual approximation, assisted by their own or a superincumbent pressure, in the same manner as I have just stated that plates of lead or other metals unite to metals.

II. But there are substances that are UNLIKE IN THEIR NATURE, as solids and fluids, for instance, that under particular circumstances are often found to exhibit a mutual attraction ; whence this mode of union is called

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* Reid, in Nicholson's Journal, vol. xxxiii. p. 92.

† Gilb. xiii. 124. Young's Nat. Phil. ii. 159.

HETEROGENEOUS ATTRACTION, and, from its occurring most palpably between liquids and solid substances possessing small capillary or hair-tubes, CAPILLARY ATTRACTION.

The cause of this attraction is obvious; and it is still more clearly a mere modification of the general attraction of gravitation, than the preceding power of homogeneous attraction. It is the common attractive property of material substance for material substance; the liquid, or that whose particles are easily separable, pressing towards the solid, whose parts are by any action of their own altogether inseparable. Hence the reason why water or any other liquid hangs about the sides of a wine-glass: hence, partly, the reason why a wine-glass, when somewhat more than brimful of a liquid, does not overflow; the co-operative reason being, as I have already stated, the homogeneous attraction of the corpuscles of the fluid for each other, which prevents them from separating readily; and hence also the reason why a liquid contained in a narrow-necked and inverted phial does not obey the common attraction of gravitation, and fall to the earth, although the stopper be removed to allow it, till we aid the power of gravitation, or rather loosen the power of the peculiar attraction, by shaking the phial.

In this last case it is manifest that the heterogeneous attraction, or that between the two different substances, is stronger than the common force of gravity. In minute capillary tubes or pores this is still more obvious. Such are the pores of a piece of sponge, when pressed or softened, so as to become more pliable to the action of water or of any other liquid within its reach. For, in this case, the water being minutely divided by the pores of the sponge into very small portions, and still surrounded by the pores in every direction after such division, has its common force of gravitation and its peculiar force of homogeneous attraction equally overpowered; and ascends from the surface of the earth, instead of descending to it, or uniting into a spherical form; and the same kind of pores, and, consequently, the same kind of power, being continued to the upmost height of the sponge, it will rise to the full extent of its column. The tubes of various imperfect crystals, as those of sugar, for example, are still smaller: and hence the lateral attraction must be still stronger; and any liquid within its reach will rise both higher and more freely, till the sugar at length becomes dissolved, and, consequently, its pores are totally destroyed. The cause of capillary attraction is therefore obvious: and the reasoning and phænomena now submitted may be applied to an explanation of every other species of the same kind that may occur to us.

III. The third particular attraction I have noticed, is that of PECULIAR BODIES FOR PECULIAR BODIES, and which has hence been denominated ELECTIVE OR CHEMICAL ATTRACTION; as the tendencies they have to each other have been denominated AFFINITIES. Thus lime has a strong affinity for carbonic acid, and greedily attracts it from the atmosphere, which hence becomes purified by being deprived of it. But the same substance has a still stronger affinity for sulphuric acid, and hence parts with its carbonic acid, which flies off in the form of gas, in order to unite with the sulphuric whenever it has a possibility of doing so. It is highly probable that this kind of attraction is also nothing more than a peculiar modification of that of gravitation, more select in its range, but more active in its power. To trace out the various substances that are possessed of this peculiar property, and to measure the degrees of their affinities, is one of the chief branches of chemistry, but of too voluminous a nature to touch farther upon at present.

IV. V. The two remaining kinds of attraction to which I have adverted, those of ELECTRICITY and of MAGNETISM, are still more select, and perhaps still more powerful than even the preceding: but the phænomena to which they give rise cannot, I think, be attributed to any modification of a gravitating ethereal medium, we call the medium in both these cases a fluid, but we know little or nothing of the laws by which they are regulated; whether they be different substances, or, according to M. Ampore, the same substance under different modifications, or whether, in reality, they be material substances at all. They are certainly deficient in the most obvious properties of common matter, and may be another substrate of being united to it.

There are also two other substances, or which are generally conceived to be substances, in nature, of a very attenuate texture, which largely contribute to the changes of material bodies. I mean LIGHT and HEAT, of the general nature of which we are still also in a considerable degree of ignorance. Like the powers of magnetism and electricity, we only know them, and can only reason concerning them, by their effects. These effects, indeed, are of a most curious and interesting character, but spread too widely to be followed up in the course of the present lecture, though we may endeavour to pursue them, and, as far as we are able, to develope them hereafter.

All these four powers or essences, for we know not which to call them, concur in exhibiting none of the common properties of matter; their respective particles repel each other at least as powerfully as they attract, and in the cases of light and heat repel alone, and without attracting. They may, possibly, be ponderable; but if so, we have no instruments fine enough to detect their relative weights; and we are hence incapable of determining, as I took leave to observe on a former occasion, whether they be matter at all, whether mere properties of matter, or whether modifications of some etherealized and incorporeal substrate, combining itself with the material mass, and exciting many of its most extraordinary phænomena. It is at present, however, very much the habit to generalize them into one common origin; and to conceive the whole as modified results of matter, or of the gravitating property of matter. Thus, the attractive powers of chemical affinity and of electricity are identified in the following passage of Sir Humphry Davy's valuable "Elements of Chemical Philosophy:"—"Electrical effects are exhibited by the same bodies when acting *as masses*, which produce chemical phænomena when acting by their *particles*; it is not improbable, therefore, that the primary cause of both may be the same."* And in like manner, in an adjoining passage, he suggests that all the various properties or essences that have thus far passed in survey before us may be nothing more than the general attractive power of matter, though he admits that at present we are incompetent to determine upon the subject. "With regard to the great speculative questions, whether the electrical phænomena depend upon one fluid *in excess* in the bodies positively electrified, and *in deficiency* in the bodies negatively electrified, or upon two different fluids capable by their combination of producing heat and light, or whether they may be *particular exertions of the general*

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* Elem. p. 164, 165.

attractive power of matter, it is perhaps impossible to decide, in the present imperfect state of our knowledge."*

And hence, heat, in the view of Sir Humphry Davy, Count Rumford, and various other justly celebrated chemists and philosophers of the present day, coincidently with the doctrine of the Peripatetic school, is a mere property of matter, and not a substance sui generis, as was contended for by the Epicureans, in opposition to the disciples of Aristotle, and is contended for by the disciples of Boerhaave, Black, Crawford, and most of the chemists of our own times. The cause of heat, among those who deny it a substantive existence, consists in a vibrating motion of the constituent particles of the heated body, too rapid to be traced by the eye. And as it is known to every one that bodies in general, as they become heated, occupy a larger space, and have their particles more widely repelled and separated from each other than in a colder temperature, it has of late become a favourite doctrine that the repulsive power, which in our last lecture we noticed to exist throughout matter, depends altogether upon the property of heat; in consequence of which Sir Humphry Davy uses heat and calorific repulsion as synonymous terms, and hence regards heat and gravitation, or general attraction, as antagonist powers.

There is much plausible reasoning to be urged in favour of this hypothesis. It will as readily account for many, perhaps most, of the phenomena which accompany bodies in their change from one temperature to another, as the position of the substantive form of heat, and has some advantage in point of simplicity; but it is opposed by a variety of facts of so stubborn and intractable a nature, that no efforts of ingenuity have hitherto been capable of bending them into the service of the new doctrine. I observed, for instance, in our last lecture, that when two plates of glass are within a ten thousandth part of an inch of each other, they cannot be made to approach nearer without a strong additional pressure. I observed, farther, that Professor Robison has calculated the extent of this pressure from actual experiment, and finds it amount to not less than a thousand pounds weight for every square inch of the glass. Now this resistance or repulsive power between the two plates of glass takes place equally under an air-pump and in the fullest exposure to the air of the atmosphere, but it appears to cease under water. By what cause the repulsion is excited in the two former instances, or disappears in the latter, we know not; but it does not seem possible for any ingenuity of argument to connect this repulsive power with heat, whether regarded as a substance or a mere property.

Heat, again, which undoubtedly makes the particles of iron repel each other, so that given weights of them occupy a larger space—makes the particles of a ball of clay on the contrary attract each other into a closer approximation, so as very considerably to lessen its dimensions; and it was on account of this peculiar property that Mr. Wedgewood selected this last material for the purpose of forming his celebrated pyrometer, or instrument for measuring intense heats, the increase of the heat being indicated by the decrease of the mass of clay.

So water, at about 42° of Fahrenheit, which forms its medium of density, begins to expand upon exposure to heat, and continues to expand in proportion as additional heat is applied; but below 42° it begins to expand also, upon exposure to cold, and continues to expand in the very same ratio upon the application of additional cold, till at 32° it freezes and becomes fixt. This curious phænomenon has never been accounted for. If calorific repulsion produce the expansion above 42°, what is it that produces the same effect below? We can, perhaps, explain the cause of the expansion during the act of freezing, from the peculiar shape of the crystals which the water assumes in the act of consolidating; but this explanation will in no respect apply to the expansion of the water when it reaches the freezing point. In this curious and unillustrated fact cold appears to be as much entitled to the character of a repulsive power as heat.

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* Elem. p. 176.

For these and numerous other reasons, therefore, heat is even at the present moment usually regarded, not as a mere quality of body produced by internal vibration, and forming an antagonist power to the attraction of cohesion, but as a distinct and independent substance. The sources of heat are various, though by far the principal reservoir throughout the whole solar system is the sun himself, which Dr. Herschel believes to be perpetually secreting the matter of heat from those dark and discoloured parts on its surface which we call spots, by many astronomers regarded as volcanoes, and many of which are larger than, and some of them five or six times as large as, the diameter of the earth! This material Dr. Herschel supposes to be first thrown off in the form of an atmosphere, and afterwards this atmosphere to be diffused in every direction through the whole range of the solar empire: and, in the Philosophical Transactions for 1801, he has endeavoured to show that the variation in the heat of different years is owing to the more or less copious supply of fuel which such spots communicate.

This opinion I at present merely glance at; as it is my intention on a future occasion to examine its validity, as well as to trace out the other sources from which heat is derived, and to take a survey of the laws by which it is regulated. It will form a progressive part of that investigation to follow up the general nature of light; to try the question whether it be a substance or a property; and if a substance, whether distinct from a mere modification of heat. I shall at present only observe, that, in one of the latest opinions of the philosopher to whom I have just adverted, it is not only a substance, but the source of all visible substances, and the basis of all worlds.

Dr. Herschel has recently taken great pains to prove, but with no small degree of repugnancy to a former hypothesis of his, that the luminous fluid which so often appears in the heavens on a bright night, and shoots streaks athwart them, is diffused light, existing independently of suns or stars, though perhaps originally thrown forth from them; another kind of ethereal matter being sometimes united with that of light, and hence rendering it at times capable of opacity. In this diffused state he calls every distinct mass a nebulosity; he conceives all its particles to be subject to the common laws of gravitation, or the centripetal force; and that certain circumstances, unknown to us, may have occasionally produced a nearer approximation between some particles than between others; whence the diffused nebulosity is, in such part, converted into a denser nucleus, which, by its comparative preponderancy, must lay a foundation for a rotatory motion, and attract and determine the circumjacent matter still more closely to itself, and consequently diminish the extent of the nebulous range.

The nuclei thus arising may sometimes be double or triple, or still more complicated; and whenever this occurs, the nebulosity will be broken into different nebulæ, or smaller nebulous clouds; and if some of them be much minuter than others, the minuter may at length attend upon the larger, as satellites upon a planet: and Dr. Herschel gives instances of all these phænomena actually completed, or in a train of completion, in different parts of the visible heavens.

Such he submits as his latest opinion of the general construction of the heavens; believing stars, planets, and comets to have originated, and to be still originating, from such a source; the nebulous matter contained in a cubical space seen under an angle of ten degrees demanding a condensation of two trillion and two hundred and eight thousand billion times before it can be so concentrated as to constitute a globe of the diameter and density of our sun.

Some of these masses of light are indistinct and barely visible even by Dr. Herschel's forty feet telescope; and he hence calculates, that if a mass thus traced out contain a cluster of five thousand stars, they must be eleven millions of millions of millions of miles off. M. Huygens entertained an analogous idea; and conceived that there are stars so immensely remote that their light, although travelling at the rate of eleven millions of miles in a minute, and having thus continued to travel from the formation of the earth, or for nearly six thousand years, has not yet reached us.

But this sublime conception is of much earlier origin; and it is due to the magnificence of the Epicurean scheme to state that it is to be found completely developed among its principles. Lucretius has beautifully alluded to it in lines of which I must beg your acceptance of the following feeble translation, the only difference being, that lightning or the electric fluid, is here employed instead of light, at least by Havercamp; for Vossius, in the Leyden edition, gives us *light* for *lightning*, reading *lumina* instead of *fulmina*.

The poet is speaking of the immensity of space:—

The vast whole
What fancied scene can bound? O'er its broad realm,
Immeasur'd, and immeasurably spread,
From age to age resplendent lightnings urge,
In vain, their flight perpetual; distant, still,
And ever distant from the verge of things.
So vast the space or opening space that swells,
Through every part so infinite alike.*

From this immense range of nebulous light Dr. Herschel derives comets as well as stars and planets, believing them, indeed, to be the rudiments of the two latter; and he has especially noticed, as originating from this source, the well remembered comet that so brilliantly, and for so long a period of time, visited our horizon during the close of the year 1811; which he conceives will be converted into a stellar or planetary orb as soon as its luminous matter, and especially that of its enormous tail, shall be sufficiently concentrated for this purpose. This tail he calculated, when at its greatest apparent stretch in October of the same year, at something more than a hundred millions of miles long, and nearly fifteen millions broad, though its bright or solid nucleus or planetary body was not supposed to measure more than four hundred and twenty-eight miles. Its perihelion path, or nearest approach to the sun, is stated at a distance of ninety-seven millions of miles, its distance from the earth at ninety-three millions. The comet of 1807 approached the earth within sixty-one millions of miles, or about a third nearer the earth, and that of 1680 within a sixth of its diameter, or as near as 147,000 miles, its tail being of a like length.

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* Omne quidem vero nihil est quod finiat extra.
Est igitur natura loci, spatiumque profundi,
Quod neque clara suo percurrere fulmina cursu
Perpetuo possint ævi labentia tractu;
Nec prorsum facere, ut restet minus ire, meando
Usque adeo passim patet ingens copia rebus,
Finibus exemptis, in cunctas undique parteis.†

† De Rer. Nat. i. 1000.

There is one comet, however, that we seem to be somewhat better acquainted with than with this that paid us so near a visit, or indeed than with any other, from its having approached us visibly for four times in succession, if not oftener. It was towards the beginning of last century that Mr. Halley was struck with the remark, that the general elements and character of the comets observed in 1531, 1607, and 1682, were nearly the same; whence he concluded that the whole formed but one identical body, that took about seventy-six years to complete its eccentric orbit; and hence, although in consequence of this eccentricity, and its travelling amidst a range of heavenly bodies that are altogether invisible to us, and whose influence seems to bid defiance to calculation, it is difficult to form an estimate of its progress, he ventured to suggest, that it would appear again, making due allowance for these incidents, towards the close of 1758, or the commencement of 1759: and he had the high satisfaction of seeing his prediction verified; the comet passing its perihelion March 12th, 1759, within the limits of the errors of which he thought his results susceptible. It is apparently this comet, which at this last period only excited the curiosity of astronomers and mathematicians, that in 1456, or four revolutions earlier, towards the close of what are called the dark ages, spread such consternation over all Europe, already, indeed, terrified by the rapid successes of the Turkish arms, that Pope Calixtus was induced to compose a prayer for the whole western church, in which both the Turks and the comet were included in one sweeping anathema.

Admitting the truth of Dr. Herschel's hypothesis, as we are now contemplating it, it is possible that some of the lately discovered planets, which are now attendant upon the sun, were formerly comets, whose orbits have for ages been growing progressively more regular, as well as their constitutional rudiments more dense; and such, indeed, is the opinion of M. Voight, and of various other philosophers on the continent.

The object of the present and the preceding lecture has been to submit a sketch of the most obvious properties belonging to MATTER, so as to enable you to obtain a bird's-eye-view of the general phænomena it is capable of assuming, and the general changes it is necessarily sustaining. From the qualities I have placed before you, of passivity, cohesibility, divisibility, and attractions of various kinds, must necessarily result, according to the intensity with which they are called into action, the phænomena of liquidity, viscidity, toughness, elasticity, symmetry of arrangement, solidity, strength, and resilience. But the powers which thus perpetually build up the inorganic world, and to this our survey has been entirely confined, perpetually also destroy it: for the whole, as I have had occasion to observe, is a continued circle of action; a circle most wise, most harmonious, most benevolent: and hence, as one compound substance decays, another springs up in its place, and can only spring up in consequence of such decay.

There is, however, another lesson, if I mistake not, which we may readily learn from these lectures, however imperfectly delivered, and which is altogether of a moral character: I mean that of humility in regard to our own opinions and attainments; and of complacency, in regard to those of others. After a revolution of six thousand years, during the whole of which period of time the restless ingenuity of man has been incessantly hunting in pursuit of knowledge, what is there in physical philosophy that is thoroughly and perfectly known even at the present moment? and of the little that is thus known, what is there which has been acquired without the clash of controversy, and the warfare of opposing speculations? Truth, indeed,—for ever praised be the great Source of Truth, for so eternal and immutable a decree—has at all times issued, and at all times will issue, from the conflict; but while we behold philosophers of the highest reputation, philosophers equally balanced in the endowment of native genius, proved by the great teacher Time to have been alternately mistaken upon points to which they had honestly directed the whole acumen of their intellect, how absurd, how contemptible is the fond confidence of common life! Yet what indeed, when fairly estimated by the survey that has now been briefly taken of the sensible universe,—what is the aggregate opinion, or the aggregate importance of the whole human race! We call ourselves lords of the visible creation: nor ought we at any time, with affected abjection, to degrade or despise the high gift of a rational and immortal existence.—Yet, what is the visible creation? by whom peopled? and where are its entrances and outgoings? Turn wherever we will we are equally confounded and overpowered: the little and the great are alike beyond our comprehension. If we take the microscope it unfolds to us, as I observed in our last lecture, living beings probably endowed with as complex and perfect a structure as the whale or the elephant, so minute that a million of millions of them do not occupy a bulk larger than a common grain of sand. If we exchange the microscope for the telescope, we behold man himself reduced to a comparative scale of almost infinitely smaller dimension, fixed to a minute planet that is scarcely perceptible throughout the vast extent of the solar system; while this system itself forms but an insensible point in the multitudinous marshallings of groups of worlds upon groups of worlds, above, below, and on every side of us, that spread through all the immensity of space, and in sublime, though silent harmony declare the glory of God, and show forth his handy-work.

LECTURE VI.

ON GEOLOGY.

There are some subjects on which the philosopher is obliged to exercise nearly as much imagination as the poet; for it is the only faculty by which he can expatiate upon them. Such is a great part of the magnificent study upon which we have touched in our preceding lectures.—Space, immensity, infinity, pure incorporeal intelligence, matter created out of nothing, innumerable systems of worlds, and innumerable orders of beings;—where is the mind strong enough to grapple with such ideas as these? They at once entice and overwhelm us. Reason copes with them till she is exhausted, and then gives us over to conjecture. Hence, as we have already seen, invention at times takes the place of induction, and the man of wisdom has his dream as well as the man of fancy.

Let us descend from such magnificent flights: let us quit the possible for the actual; and equally incapable of following up the fugitive material of which the visible universe consists, into its elementary principles and collective mass, let us examine it as far as we are able, in the general laws, structure, and phænomena it exhibits in the solid substance of the globe on which we tread.

It is this inquiry that constitutes the science of GEOLOGY, a brief outline of which is intended as a study for the present lecture;—a science than which few are of more importance, but which is only at present in its infancy, and of course almost entirely indebted for its existence to the unwearied assiduity and discoveries of modern times.

The direct object of geology is, to unfold the solid substance of the earth—to discover by what causes its several parts have been either arranged or disorganized—and from what operations have originated the general stratification of its materials, the inequalities of its surface, and the vast variety of bodies that enter into its make.

In pursuing this investigation, many difficulties occur to us. The bare surface, or mere crust of the earth's structure, is the whole we are capable of boring into, or of acquiring a knowledge of, even by the deepest clefts of volcanoes, or the deepest bottoms of different seas. It is not often, however, that we have the power of examining either seas or volcanoes so low as to their bottom. The inhabitable part of the globe bears but a small proportion to the uninhabitable, and the civilized an almost infinitely smaller proportion still. Hence our experience must be extremely limited; a thousand facts may be readily conceived to be unfolded that we are incapable of accounting for; and, at the same time, a variety of contradictory hypotheses to be formed, with a view of accounting for them.

So far as the superficies of the earth has been laid open to us by ravines, rivers, mines, earthquakes, and other causes, we find it composed of a multitude of stony masses, sometimes simple, or consisting of a single mineral substance, as limestone, serpentine, or quartz; but more frequently compound, or constructed of two or more simple materials, variously intermixed and united; as granite, which is a composition of quartz, felspar, and mica; and sienite, which is a composition of felspar and hornblend. These stony masses or rocks are numerous, and they appear to be laid one over the other, so that a rock of one kind of stone is covered by a rock of another kind, and this second by a third kind, and so on, in many instances, for a very considerable number of times in succession. In this superposition of rocks it is easily observable that their situation is not arbitrary. Every stratum occupies a determinate place; so that they follow each other in regular order from the deepest part of the earth's crust, which has been examined, to the very surface. Thus there are two things respecting rocks which claim our peculiar attention—their composition and their relative situation. And independently of the rocks thus considered as constituting almost the whole of the earth's crust, there are other masses of fossil materials that must be likewise minutely studied; which traverse rocks in a different direction, and are known by the name of veins; as if the rocks had been split asunder in different places from top to bottom, and the chasms had been afterwards filled up with the matter which constitutes the vein. And hence the VEINS which intersect rocks are as much entitled to our attention as the STRUCTURE and SITUATION of the rocks themselves.

Rocks, as to their STRUCTURE, may be contemplated under two divisions, *simple* and *compound.*

The simple division is, however, rather a speculative than a practical contemplation. It is possible that rocks, and of immense magnitude, may exist in parts of the globe we are not acquainted with, that are perfectly simple and unmixed in their structure ; but it is seldom, perhaps never, that they have been actually found in such a state, at least to any considerable extent.

It is only under a compound form, therefore, or as composed of more than one mineral substance, that rocks are to be contemplated in our present survey of the subject ; and in this form we meet with them of two kinds : CEMENTED, or composed of grains, or nodules, agglutinated by a cement, as sandstone and breccia or pudding-stone ; and AGGREGATED, or composed of parts connected without a cement, as granite and gneiss. The component parts of the cemented rocks are often very multifarious ; those of granite and gneiss much less so, consisting chiefly of felspar, mica, and quartz, with garnets, shorl, or hornblend occasionally intermixed with the mass. The granite that forms the flagstones of Westminster Bridge are supposed to have been brought from Dartmoor ; and, like the rest of the Dartmoor granite, is remarkable for the length of its crystals of felspar, which in some instances are not less than four inches.

The aggregate rocks, like the cemented, are sometimes found of an indeterminate, but more generally of a determinate or regular form ; and it is the office of that branch of mineralogy to which M. Werner has given the name of *oryctognosy*, to distinguish and describe them by these peculiarities. This is a branch into which I cannot plunge, for it would lead us from that general view of the science to which our present course of study is directed, into a detailed analysis. Those who are desirous of pursuing it in this line of developement may consult with great advantage Professor Jameson's System of Mineralogy, or M. Brogniart's "Traité Elémentaire," or M. Cuvier's Essay on the Theory of the Earth, prefixed to his Fossil Remains. I can only observe, at present, that the total number of rocky masses, or different kinds of rocks, whether simple or compound, which have been hitherto observed, amount to about sixty ; of which the principal seem to be the eight following: granite, gneiss, hornblend, limestone, wacke, basalt, quartz, and clay.

Let us next pass on, then, to consider their RELATIVE SITUATION. Of the different rocks thus glanced at, and placed over each other, the whole crust of the earth is composed, to the greatest depth that the industry of man has been able to penetrate ; and I have already observed, that, with respect to each other, they occupy a determinate situation which holds invariably in every part of the globe. Thus, limestone, excepting under particular circumstances hereafter to be explained, is no where found under granite, but always above it. This general view of the subject may indeed induce a supposition that every separate layer which constitutes a part of the earth's surface is extended round the entire globe, and wrapped about the central nucleus, like the coats of an onion ; the kind of rock that is always lowest, or nearest the centre, uniformly supporting a second kind, and this second kind a third, and so on. Now, though the different kinds or layers of rocks do not in reality extend round the earth in this uninterrupted manner—though partly from the inequality of the nucleus on which they rest, partly from their own inequality of thickness in different places, and partly from other causes, the continuity is often interrupted—yet still we trace enough of it to convince us that the rocks which constitute the crust of the earth, when contemplated upon a large scale, are every where the same, and that they invariably occupy a like situation with respect to each other.

The labours of Mr. Kirwan and M. de Saussure gave the earliest hints upon this subject; and the geological theories of Professor Werner of Freyburg, and of M. de Cuvier of Paris, are entirely founded on the same. These theories, though derived in some measure from different sources of mineralogical study, coincide not merely in their general outline, but in all their more prominent parts, and only differ in their mode of accounting for the more limited or local deposites.

M. Werner, "from whom alone," to adopt the language of M. de Cuvier, "we can date the commencement of real geology," so far as respects the mineral natures of the strata, divided, in his first view of the subject, all the various rocks that enter into the solid crust of the earth into FIVE classes.

Of these the FIRST CLASS consists of those rocks which, if we were to suppose each layer to be extended over the whole earth, would lie lowest, or nearest the centre, and be covered by all the rest; it comprises seven distinct sets, as granite, gneiss, mica-slate, clay-slate, a peculiar kind of porphyry, sienite, and a peculiar kind of serpentine. Of these, granite lies the undermost, and sienite the uppermost; and in the midst of several of them we meet with beds of not less than eight other kinds of rock, as though dropped into them by accident—as topaz, another kind of porphyry, serpentine, limestone, flint-slate, and trap, quartz, and gypsum; which are hence called subordinate rocks of this class, and which extend the whole number of sets belonging to it to fifteen.

These are supposed to have been earliest produced, and when the earth first emerged from a state of chaos to a state of order; and are hence denominated PRIMITIVE FORMATIONS. They are distinguished by the following character. Not a single relic of either animal or vegetable petrifaction is to be found in any of them. The lowermost or older contain no carbonaceous matter; which is discoverable but very sparingly in the superior or newer. They are all chemical combinations, and generally crystallized; the crystallized appearance being most perfect in the oldest, and gradually becoming less perfect in the newer formations. I have already observed that the whole of this scale of formation does not regularly coat the nucleus of the earth; so little so, indeed, that sometimes even the granite itself, the lowermost rock of all, is left bare, and not pressed down or coated by a deposite of any other kind of rock: and so of the rest. Wherever this deficiency takes place, the rock thus left at liberty rises uniformly higher than it is found to do where pressed upon and invested with its common coatings. But every rock does not, under such circumstances, rise equally high, or with an equal degree of freedom; for granite rises highest of all: and hence we frequently find it composing the tops of our loftiest chains of mountains, as well as the basis of the earth's solid crust. It forms the great body of the Swiss mountains and the Alps, though gneiss is here also found in great abundance.

The level of gneiss, when left at equal liberty, is a little lower than that of granite. It constitutes the vast mass of the Carpathian mountains that divide Transylvania and Hungary from Poland.

The level of mica-slate is lower than that of gneiss, and the level of clay-slate lowest of all. So that there is a regular sinking of these respective levels from granite to clay-slate: while the newer porphyry and sienite are often laid over their summits, as though these two formations had been deposited long after the production of the others; an idea which is still further strengthened by our meeting occasionally with a bed of breccia, or pudding-stone, composed of fragments of the older or lower rocks, capping the gneiss, granite, or other formation before the porphyry or sienite has been deposited.

The SECOND CLASS of rocks, or that which, when the number of coatings is complete, lies immediately over the preceding, consists of gray-wacke slate, and a peculiar kind of limestone, green-stone, and amygdaloid; together with subordinate masses of the proper primitive formations, sienite, porphyry, and granite: as though some portions of these had become crystallized after the rest, along with the next layers in succession, or had been separated from the parent rocks by some early commotion. Gray-wacke, which is a concrete term, denoting a conglomerate rock of a peculiar kind having a basis of clay-slate, and being studded or otherwise intersected with portions of quartz, felspar, and scales of mica, may be exemplified by what in Cornwall is called *killas*, a far more euphonous word; and hence gray-wacke and gray-wacke slate may be distinguished by the terms *amorphose* and *schistose* killas. The Cornish killas lies directly over the granite of that country, which possesses the character ascribed by Werner to granite of the highest antiquity.*

These formations, for the most part, irregularly alternate with each other, instead of preserving one regular and successive order, as the different sets of the primitive formations do; excepting that the limestone appears usually undermost, and placed, as the basis of the rest, upon the sienite or uppermost of the first class. It is in this second class of formations that petrifactions first make their appearance; and it deserves particular attention that they are uniformly confined, both in the animal and vegetable kingdoms, to those of the lowest links in the scale of organization; and even among these to species which are at present altogether unknown, and which appear therefore to be totally extinct. Thus the animal petrifactions consist entirely of ammonites, mytilites, unknown corals, and other zoophytic worms; and the vegetable petrifactions of reeds, ferns, and other palm-like plants, mosses, and other cryptogamic productions, which occupy the lowest part in the scale of vegetable life, as zoophytic worms do among animals. It is here, also, that carbonaceous matter, which is chiefly of vegetable origin, first makes its appearance in any considerable quantity.

To this class of rocks, therefore, M. Werner has given the name of TRANSITION FORMATIONS; as believing them to have been produced while the earth was in a state of transition from inorganic matter to organic life, —from an uninhabited to an inhabited condition. The date of their formation, however, is proved, even from their natural appearance, to have been very remote; since, as already observed, the whole of the petrifactions which they contain consist of plants and animals, not only of the very lowest species, but which now seem to be altogether extinct.

The THIRD CLASS of rocks is denominated FLOETZ, that is, FLAT OF HORIZONTAL, FORMATIONS, in consequence of their usually appearing in beds much more nearly horizontal than the preceding. They lie immediately over the transition-class, and consist of the twelve following distinct sets of rock, each of which is generally found in a particular situation: sandstone of different kinds, and differently arranged, three sets; limestone, three sets; gypsum, two sets; calamine; chalk; coal; trap. The trap usually covers the whole of this class, as the newer porphyry and sienite cover the primitive formations: the relative position of the rest is more variable. The floetz or horizontal class is characterized by its containing an abundance of petrifactions in every one of its sets, and these of known animal and vegetable kinds; though still, of those that occupy the lower parts of the scale, as shells, fishes, the fishes much mutilated, a few tortoises, ferns, pines, and reeds; indicating that they were formed at a period in which organized beings of this character abounded, but in which those of other characters did not exist, or but rarely.

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* See Allan's remarks on the transition-rocks of Werner, in Thomson's Annals of Philos. vol. iii. p. 28. Compare with Jameson's definition of the same. Id. Feb. 1817, p. 17.

The FOURTH CLASS of formations, under the Wernerian system, is denominated ALLUVIAL, and constitutes the great mass of the actual surface of the earth's solid crust. They have been evidently produced by the gradual action of rain, river-water, air, and the elastic gases, upon the other classes, and may, comparatively, be considered as very recent formations, or rather as deposites, whose formations are still proceeding. They may be divided into two kinds; those deposited in the valleys of mountainous districts, or those elevated plains which often occur in mountains; and those deposited upon flat land.

The first kind consists of sand, gravel, and similar materials, which constituted part of the neighbouring mountains in their original state, and which remain, notwithstanding that these less durable parts have been thus washed or blown away. They sometimes contain ores, which also existed in the neighbouring mountains, and have been carried down by the agency of rain, air, or the elastic gases. The ores principally discovered in such situations are those of gold and tin; and these soils are often washed in order to separate them. Beds of loam are also occasionally met with on the plains of mountains, formed of the decomposed elements of animal and vegetable bodies that once occupied their sides.

The second kind of alluvial deposites, or that which occupies the flat land, consists of loam, clay, sand, marl, calcsinter, and calctuff, or stalactitic tufa, the basis of our common petrifactions; and which is found very largely in Sweden, Germany, and Italy, clothing with a calcareous coat the smaller branches of trees, leaves, prickles, moss, and other minute plants; eggs, birds, and birds-nests; preserving them from decay, by defending them from the action of the air. The clay and sand sometimes contain petrified wood; and in many parts are found the skeletons of quadrupeds, even of the largest magnitudes, as we shall have occasion to observe hereafter.* Here, also, occur earths and brown coal (in which is often traced mineral amber), wood-coal, bituminous wood, and bog iron ore.

The LAST, OF UPPERMOST, of THE FIVE CLASSES of rocks of the Wernerian system, is denominated VOLCANIC FORMATIONS; and consists of two distinct sets, false and true.

The false comprise mineral substances which have experienced a change from the combustion of beds of coal situated in the neighbourhood: the chief materials which are thus altered are porcelain, jasper earth, slag, burnt-clay, columnar clay iron-stone, and, perhaps, polishing slate.

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* See Series II. Lect. II. On zoological systems, and the distinctive characters of animals

The real volcanic minerals are those which have been thrown out of the crater of a volcano, and consist of three kinds: first, those which, having been discharged frequently, have formed the crater itself of the mountain: secondly, those which have rolled down in a stream, and are known by the name of lavas: and, thirdly, the residual matter contained in the water which is often ejected, composed of ashes and other light substances, and which, when rendered solid by evaporation, is denominated volcanic tuff or tufa.

I have observed, that these different classes of mineral formations are often traversed in various directions by other mineral substances which are called VEINS, as if the rocks they compose had split asunder in different places from top to bottom, and the chasms had been afterwards filled up from other sources. These transverse lines or veins are worthy of notice in regard to their *shape* and the *substances* with which they are filled.

With respect to their *shape*, they appear to be almost always widest above, and gradually to diminish as they deepen, till at last they terminate in a point; exactly as if they had been originally fissures in the rock. Occasionally, indeed, they are observed to widen and contract alternately in different parts of their course, but this is by no means a common appearance.

Sometimes they are partially or altogether empty; and in this case they are real fissures, and are so denominated; but generally they are filled with matter more or less simple, and more or less different from the rock through which they pass. All the formations I have already noticed as existing in the shape of rocks have also been found in the shape of veins: whence we have veins of granite, porphyry, limestone, basalt, wacke, green-stone, quartz, clay, felspar, pit-coal, common salt, and metals of every kind. When the veins are compound, or consist of a variety of substances, these substances are almost always disposed in regular layers; one species of mineral constituting a central line or cylinder, and this being incrusted with a second mineral, and the second with a third, and in the same manner to the utmost sides of the veins. These layers are occasionally very numerous; that of the vein Georgius at Freyburg consists of not less than nine, and there is another in the same district, which, according to M. Werner, extends to thirteen. It is not uncommon to find veins crossing each other in the same rock; and when this occurs, one of the veins may be traced passing through the other without any interruption, and completely cutting it in two, the cut vein always separating and vanishing at the point of intersection.

Nothing appears more obvious than that these veins must have been originally fissures produced by some unknown violence in the rocks in which they occur; and it is highly probable, as conjectured by M. Werner, that the mineral materials which constitute them have been deposited slowly from above during the formation of the different classes or sets of rock of which the different layers consist, while the rocks in which they occur were covered with water. Upon this theory veins are of course newer than the rocks in which they are met with, and which must have split to have produced them; and where two veins cross each other, that is obviously the newest that traverses the adjoining without interruption, as the fissures constituting the second vein must have been formed after the first was filled up.

The FIVE classes of rock formations we have thus far considered are those which entered into Professor Werner's system, as it first made its appearance. They are supposed to exist over the globe generally, and to be independent of chorographic or topographic changes, and have hence been still further denominated UNIVERSAL FORMATIONS.

M. Werner has since, however, been induced to add to these a SIXTH class, consisting of what he has called PARTIAL OR LOCAL FORMATIONS: comprising those which are so often found in vast hollows or basins of particular countries; the materials of which are, in many instances, strangely intermixed, and have probably been carried down into such basins by circumscribed deluges, produced by an exundation of rivers or seas, occasionally alternating with each other, or by other partial disruptions. We have here, therefore, reason to expect,—what in fact is perpetually met with,—a motley combination of whatever substances may have existed in the course of such seas or rivers or rifted soils, with masses or fragments of most of the UNIVERSAL FORMATIONS, alternate beds of marine and fresh-water alluvions, and, consequently, animal and vegetable remains of all kinds.

The composite rocks that fill up the great basin around Paris, in which the skeletons of so many unknown animals, even quadrupeds of the hugest size, elephants, hippopotami, tapirs, mammoths, and other pachydermatous, or thick-skinned monsters, have been discovered, are of this LOCAL FORMATION. The celebrated quarries of Æningen, on the Rhine, are of a like kind; and these, having been erroneously regarded of the same antiquity as Werner's UNIVERSAL FORMATIONS, have been appealed to by various writers as affording proofs of the falsity of his theory.*

We have other instances of this *local* formation in many parts of our own country, and particularly near the banks of the Thames. Mr. Trimmer has given an interesting account of the substrate of two fields in the vicinity of Brentford, that are loaded with the organic remains of the larger kinds of quadrupeds; as bones of elephants, approaching to both the Asiatic and the African species; horns of deer, apparently as enormous as those dug up in Ireland; bones of the bos genus; and teeth and bones of the hippopotamus; the last very abundant, and intermixed with fresh water shells,† and other fresh-water relics.

Occasionally, however, marine remains are found intermingled with such animal fossils, and composing their beds instead of those of fresh-water; and not unfrequently layers of the one kind, as in the basin of Paris, are irregularly surmounted by layers of the other. But no human skeletons are discovered in the midst of any of these rocks, although the bones of man are as capable of preservation as those of any other animal: the only known instance of this sort being that imported into our own country from Guadaloupe by Sir Alexander Cochrane, and which is now exhibited in the British Museum, imbedded in a block of calcareous stone; a very accurate description of which has been published in the Philosophical Transactions by Mr. König.

It is hence obvious, that the catastrophes which involved these enormous quadrupeds in destruction must have occurred at a period when mankind had no existence in the regions which were thus overwhelmed; and in some places overwhelmed alternately by disruptions and inundations of sea and of fresh water. And it is equally obvious, that as the fossil bones are not rolled or violently distorted, or deprived of their natural contour, such remains have not been brought to their present beds from a distance; but that the deluge must have been sudden, and overtaken them in their natural resorts; and hence may, in many cases, have swept away all the individuals of a species in a common calamity.

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* For an admirable defence of this part of the theory, see Mr. Jameson's essay "On Formations," inserted in the Annals of Philos. no. iii. p. 191.

† Phil. Trans. for 1813, p. 135. See also Mr. Webster's valuable essay on the same subject, in vol. ii. of the Transactions of the Geological Society.

There is, however, a great difficulty with some naturalists in conceiving that such animals as the elephant, the tapir, the rhinoceros, the hippopotamus, the mammoth, or mastodon, animals now only found in the torrid regions, could have existed in these northern parts of the globe. M. de Marschall endeavoured by one sweeping stroke of the fancy to solve this, as well as that of the extraordinary fragments in which they are often imbedded, and held out that the whole have fallen at different times, like meteoric stones, from heaven.* The real difficulty, however, vanishes, in a considerable degree, if not entirely, when we reflect, that although the torrid regions furnish us with some of these genera, they do not appear in any instance to contain the same precise species as are traced among the large fossil quadrupeds of the northern and colder parts: and hence it is no argument, that because the habits of the extant species do not qualify them for a residence in these latter regions, such situations might not have furnished a comfortable home to the species whose remains are found among us. The fossil species do not differ less from the living to which they make the nearest approach, than various animals that are familiar to us do from others that belong to the same tribes, and which are found under one species or other, over the whole world. The race of horses, of swine, or of sheep, furnishes us with abundant examples of this remark: and that of dogs affords perhaps a still more striking illustration; for while under one form, that of the *isatis* or Arctic fox, the canis *Lagopus* of Linnæus, we find it in the northernmost coast of America, and even the frozen sea, living in clefts, or burrowing on the naked mountains, and in that of the almost infinite varieties of the c. *familiaris*, or domestic dog, in the bosom of our own country,—in the form of the c. *aureus*, chacal or jackal, we meet with it in the warmest parts of Asia and Barbary, prowling at night in flocks of one or two hundred individuals.

The extensive TURBARIES OF PEAT-FIELDS, which are so common to many parts of Europe, are produced by an accumulation of the remains of sphagnum and other aquatic mosses. These surround and cover up the small knolls upon which they are formed; or, in many places, descend along the valleys after the manner of the glaciers of Switzerland; but while the latter melt away every year at their lower edges, the mosses are not checked by any obstacle in their regular increase; and as such increase takes place in determinate proportions, by sounding their depth to the solid ground we may form some estimate of their antiquity.

The ordinary rise of those extensive ranges of DOWNS, which are seen skirting the coats of many countries, and especially where the shore is not very bold, is a mixt effort of sea and wind. To produce this, however, the soil that the sea washes over must consist of sand. This is first pushed in successive tides towards the shore; it next becomes dry, by being left there at every reflux of the sea; and is then drifted up the beach, and to a considerable distance from the beach, by the winds which are almost always blowing from the sea, and often in whirls or eddies; and are at length fixed by the growth of wild plants, whose seeds are in like manner wafted about on the wings of the breeze, or casually dropped with the excretions of birds or other animals that pass over them. In several parts, observes M. Cuvier, these proceed with a frightful rapidity, overwhelming forests, houses, and cultivated fields, in their irresistible progress. Those on the coast of the Bay of Biscay have actually buried a considerable number of villages whose existence is noticed in the records of the middle ages. And even in the present day they are threatening not fewer than ten distinct hamlets with almost inevitable destruction; one of which, named Mimigan, has been in perpetual danger for upwards of twenty years, from a sand-hill of more than sixty feet in perpendicular height, produced by the cause we are now contemplating, and which is very obviously augmenting.*

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* Recherches sur l'Origine, &c. Geissen, 1802.

There are various forelands on the coasts of the North Sea, and particularly on those of the counties of Sleswigh and Holstein, which are formed in the same manner.† But the most extraordinary inroads of sand-storms and sand-floods are, perhaps, those which have taken place in the Lybian Desert, and in Lower Egypt. M. Denon informs us, in his travels over this part of the world, that the summits of the ruins of ancient cities buried under mountains of drifted sands still appear externally; and that but for a ridge of mountains, called the Lybian Chain, which borders the left bank of the Nile, and forms a barrier against the invasion of these sands, the shores of the river, on that side, would long since have ceased to be habitable. "Nothing," says M. Denon, "can be more melancholy, than to walk over villages swallowed by the sand of the desert, to trample under foot the roofs of their houses, to strike against the tops of their minarets, and to reflect, that yonder, in days of yore, were cultivated fields, that hard by were groves of flourishing trees, and the dwellings of men close at hand;—and that all has now vanished."‡

The various ISLANDS that spot the surface of the sea have arisen from different causes. Many of them have been merely separated from the adjoining continent by the inroad of the sea itself upon the main-land; others have been thrown up by volcanoes, which have at times disgorged prodigious blocks of granite among the mixt materials, such as are frequently found in the Danish archipelago, in the midst of the *geest*, or alluvial matter, which has collected around them. Other islands are altogether the masonry of madrepores, and other coral zoophytes of wonderful industry and perseverance, of which the South Sea furnishes us with the largest and most astonishing specimens. These islands are for the most part flat and low, and surrounded by enormous belts of coral reefs. Most of the calcareous zoophytes are employed in their construction, but the principal worm is the madrepora *lubricata* of Linnæus.

In so large an abundance, and with so much facility, is calcareous matter elaborated by these, as well as by various other animals, and especially the testaceous worms, that M. Cuvier is inclined to ascribe all the calcareous rocks that enter into the solid crust of the earth to an animal origin.§

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* Report concerning the downs of the Gulf of Gascony, or Bay of Biscay, by M. Tassin, Mont de Marsan. an. x. Cuvier, Theory of the Earth, § 31.

† De Luc, Voyages Geologiques, tom. i.

‡ Jameson's Notes on Cuvier's Theory, &c. p. 217. Compare Dolomieu's Memoir on Egypt, in Journ. de Physique, tom. xlii.

§ Some writers have proceeded much farther than this, for they have resolved all the solid materials of the earth's crust into an organic origin. Such was the opinion of Demaillet and Lamarck; who suppose that every thing was originally fluid; that this universal fluid gave rise to plants and animals; that all clay or argillaceous earth is the produce of the former, all calcareous earth of the latter, and that siliceous earth has been the result of the two. Telliamid, p. 169. Philosophie Zoologique, *passim*.

But this is to suppose the earth of a far higher antiquity, and to have been the subject of more numerous general deluges, and inversions of sea and land, than are called for by the Wernerian system, or appear reconcileable with the Mosaic narrative. M. Cuvier apprehends, indeed, that such catastrophes may have occurred five or six times in succession, at a distance of four, five, or six thousand years from each other; and that even the chalk formation found in the basin of Paris originated in a revolution of this kind that occurred antecedently to that which is usually regarded as the flood of Noah. And, following up this idea, he conceives, towards the close of his Introductory Theory of the earth, that if the science of fossil organic productions could be carried to a much higher degree of perfection, we should be able to obtain far fuller information upon this subject; "and man, to whom only a short space of time is allotted upon the earth, would have the glory of restoring *the history of thousands of ages which preceded the existence of the human race*, and of thousands of animals that never were contemporaneous with his species."

LECTURE VII.

ON GEOLOGY.

(The subject continued.)

In our last study I attempted a brief sketch of the chief phænomena that occur to the eye of the geologist upon a survey of the solid crust of the earth, as far as he is able to penetrate into it. The conclusion to which such phænomena lead us is the following: that the rudimental materials of the globe, to the utmost depth we are able to trace them, existed at its earliest period, in one confused and liquid mass; that they were afterwards separated and arranged by a progressive series of operations, and an uniform system of laws, the more obvious of which appear to be those of gravity and crystallization; and that they have since been convulsed and dislocated by some dreadful commotion and inundation that have extended to every region, and again thrown a great part of the organic and inorganic creation into a promiscuous jumble.

Now the only two causes that can enter into the mind of man as being competent to the fluidity that appears at first to have existed throughout the whole crust of the earth are FIRE, or a peculiar SOLVENT. But, if a solvent, that solvent must have been WATER: for there is no other liquid in nature in sufficient abundance to act the part of a solvent upon a scale so extensive.

And hence our inquiries into this subject become in some degree limited, and are chiefly confined to what have been called the PLUTONIC and the NEPTUNIAN hypotheses; the origin of the world in its present state from igneous fusion, and from aqueous solution. Both these theories are of a very early date, and both of them have been agitated in ancient as well as in modern times with a considerable degree of warmth as well as of plausible argument.

Among the ancients, Heraclitus seems to have headed the advocates for the former theory, and Thales, or rather Epicurus, the supporters of the latter. In what may be regarded as modern times, Hooke may, perhaps, be held the reviver of the Plutonic system, which has since, as I have already observed, been supported by the cosmological doctrines of Buffon and Dr. Herschel. Its principal champions, however, in the present day, are Dr. Hutton, Professor Playfair,* and Sir James Hall; names, unquestionably of high literary rank, and entitled to the utmost deference, but most powerfully opposed by the distinguished authorities of Werner, whose system I have just glanced at, Saussure, Kirwan, Cuvier, and Jameson, not to mention that the general voice of geologists is very considerably in favour of the latter class of philosophers, and consequently of the Neptunian or aqueous hypothesis. Let us then take a brief view of each of these theories in their order.

According to the former, or the Plutonic conjecture, heat is the great source, not only of the original production, but of the perpetual reproduction of things. This theory supposes a regular alternation of decay and renovation. Of *decay* induced by the action of light, air, and other gases, rain and other waters, upon the hardest rocks, by which they are worn down, and their particles progressively carried towards the ocean, and ultimately deposited in its bed; and of *renovation*, by means of an immense subterranean heat, constantly present at different depths of the mineral regions; which operates in the fusion and recombination of the materials thus carried down and contained there, and afterwards in their sublimation and re-exposure to view in new strata of a more compact and perfect character. Hence the existing strata of every period consist, upon this theory, of the wreck of a former world, more or less completely fused and elevated by the agency of violent heat, and reconsolidated by subsequent cooling: of the general nature of which heat, however, we are still left in a considerable degree of ignorance. "It is not fire in the usual sense of the word," observes Mr. Playfair, "but heat, which is required for this purpose; and there is nothing chimerical in supposing that nature has the means of producing heat, even in a very great degree, without the assistance of fuel or of vital air. Friction is a source of heat, unlimited for what we know in its extent; and so, perhaps, are other operations chemical and mechanical; nor are either combustible substances or vital air concerned in the heat thus produced. So, also, the heat of the sun's rays in the form of a burning glass, the most intense that is known, is independent of the substance just mentioned; and though the heat would not calcine a metal, nor even burn a piece of wood, without oxygenous gas, it would doubtless produce as high a temperature in the absence as in the presence of that gas."†

This subterranean heat, moreover, is supposed to derive a very considerable accession of power from the vast superincumbent weight that is perpetually pressing upon its materials; in confirmation of which a variety of curious experiments are appealed to, and especially a very ingenious set lately carried into effect and described by Sir James Hall, by which it has been rendered probable, that when the gases of any fusible substance, as the carbonic acid of carbonate of lime, for example, are rendered incapable of flying off, a much less quantity of actual heat is sufficient for the purpose of fusion than when such gases, freed from a heavy compression, can escape with facility. Now, the subterranean heat being supposed to exist at prodigious depths below the surface, the substances on which it operates must be so enormously compressed, as not only to render them easily fused, but in many instances to prevent their volatilization after the fusion has taken place; and from this circumstance it is possible, we are told, to explain a variety of appearances and qualities in minerals, and to answer a variety of objections which would otherwise weigh heavy against the general theory.

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* Illustrations of the Huttonian Theory of the Earth. Edinb. 1802.
† Illustrations of the Huttonian Theory, &c.

To the principle of an alternate decay and renovation, separated from the means by which they are supposed, upon this theory, to be accomplished, there seems to be no very serious objection. It is as readily allowed by the Neptunian as by the Plutonic geologist, that the strata of the earth are liable to waste, and are indeed perpetually wasting; and that the waste materials are carried forward to the sea. But the appearance of shells in limestone and marbles, in which the sparry structure is as perfect as in primary limestone, and through which are distributed veins of crystallized carbonate of lime, together with a variety of similar facts, fatally militate against the agency of heat as an universal cause; since, in such case, allowing it to have been sufficient to produce the general effect of crystallization, every vestige of the structure of the shells must have been destroyed, and every atom of the carbonic acid totally evaporated.

It is, secondly, useless to argue, that there are other sources of heat than combustion or deflagration; because, admitting the fact to Mr. Playfair's utmost desire, it can be satisfactorily proved that all these sources are as little capable of acting in the interior parts of the globe, to the extent supposed in the theory before us, as combustion itself, which is relinquished by its defenders as incompetent to their purpose. But even allowing the full operation of all, or of any one of these causes, we have no method pointed out to us by which this subterranean heat is duly preserved and regulated—no controlling power that directs it to the proper place at the proper season, without which it must be as likely to prove a cause of havoc and disorder as of renovation and harmony. It is useless, therefore, to pursue this theory any farther. In spite of the magnificence of its structure, the universality of its application, the plausibility of its appearance, and the talents with which it has been supported, it is built upon assumption alone; it lays down principles which it cannot support, and deals in fancy and conjecture rather than in solid facts and firm evidence.

Let us next, then, take a glance at the theory by which this is chiefly opposed, and which, as I have already observed, is denominated the NEPTUNIAN.

Under this hypothesis the two substances that were first evolved out of the general chaos on the formation of the earth, and chemically united to each other, were hydrogene and oxygene, in such proportion as to produce water, which is a compound of these substances, and in such quantity as to be able to hold every other material in a state of thin paste or solution. Of the materials thus held in solution granite is supposed to have been produced first, and in by far the greatest abundance. It hence, consolidated first, probably forms the foundation of the superficies of the globe, and perhaps the entire nucleus of the globe itself; and, as has been already seen, while it constitutes the basis of every other kind of rock, rises higher than any of them. It consists, as we have already observed, of felspar, quartz, and mica, all which must therefore have concreted by a crystallization nearly simultaneous; and from its containing no organic remains, it is obvious that it must have been formed prior to the existence of the animal and vegetable kingdoms. All the other rocks, upon this hypothesis, began to crystallize and consolidate after the formation of granite, in the order in which we have already traced them ; and some of these before the whole of the granite was rendered perfectly firm, whence we trace beds of several of them in the granite formation itself; and as the same kind of action appears to apply to the whole, we, in like manner, trace beds of the newer rocks successively in formations of those that are older ; and, at last, remains of animal and vegetable materials, which are hence proved to have had an existence coetaneous with the newer classes.

The law of gravity appears to have operated through the whole of this process : and hence, water, as the least heavy material, must have risen to the surface, and purified itself by a filtration through the other materials, and at length collected in such hollows as were most convenient for its reception : these hollows constitute the bed of the ocean.

Water, thus collected in the cavity of the ocean, is carried by the atmosphere over the tops of the most elevated mountains, on which it is precipitated in rain, and forms torrents, by which it returns with various degrees of rapidity into the common reservoir. This restless motion and progress of the water in the form of rain or torrents gradually attenuate and wear away the hardest rocks, and carry their detached parts to distances more or less considerable ; whence we meet with limestone, clay, quartz or flint, sand, and mineral ores, in places to which they do not naturally belong. The influence of the air, and the varying temperature of the atmosphere, facilitate the attenuation and destruction of these rocks. Heat acts upon their surface, and renders it more accessible, and more penetrable to the moisture, as it enters into their texture ; the limestone rocks are reduced by efflorescence, and the air itself affords the acid principle by which the efflorescence is continued. Such are a few of the numerous causes that contribute to the disunion of concrete bodies, and powerfully co-operate with that wonderful fluid which alternately forms and unforms ; which creates, decomposes, and regenerates all nature.

The immediate effects of water in the shape of rain is to depress the mountains. But the materials which compose them must resist in proportion to their hardness ; and hence we ought not to be surprised at meeting occasionally with peaks, which have stood firm amid the wreck of ages, and still remain to attest the original level of the mountain-breadths which have disappeared. These primitive rocks, alike inaccessible to the assault of time and to that of the once animated beings which cover the less elevated heights with their relics, may be considered as the origin of streams and rivers. The water which falls on their summits flows down in torrents by their lateral surfaces. In its course it wears away the soil upon which it is incessantly acting. It hollows out channels of a depth proportioned to its rapidity, its quantity, and the hardness of the rock over which it passes, and at the same tide carries along with it fragments of such stones as it loosens in its progress.

These stones, rolled by the water, strike together, and mutually break off their projecting angles : and hence we obtain collections of rounded flints which line the beds of rivers, and of smaller pebbles which the sea is perpetually throwing upon the shores, often incrusted with a gravelly or calcareous edging. The powder which is produced by the rounding of the flints, or is washed down from the mountains, frequently stagnates, forms a paste, and agglutinates into fresh masses of the rocky matter of which it consists ; often imbedding flints and other materials, and constituting compound substances known by the name of pudding-stones and gritstones, which chiefly differ from each other in the coarseness or fineness of their grains, or in the cement which connects them. And if the water be loaded, as it often is, with minutely divided particles of quartz, it will proceed to crystallize whenever it becomes quiescent; and will form stalactites, agates, cornelians, rock-crystals, plain or coloured, according as it is destitute of or combined with any colouring material: and if the material with which the water be impregnated be lime instead of quartz, the crystallization will be calcareous alabaster, or marble.

Many of the earths are now known to be metallic oxydes, and all of them are suspected to be so: and hence a degree of heat capable of fusing them, and depriving them of the oxygene which gives them their oxyde form, will necessarily convert them into their metallic state. That such currents of heat, from electricity and other causes, are occasionally, and perhaps in different places perpetually, existing beneath the surface of the earth, the Neptunian is as ready to admit as the Plutonic geologist; and hence the origin of metallic minerals, of mines, ores, ochres, and pyrites.

The decomposition of animal and vegetable matter contributes largely, moreover, in the view of the system now before us, to the changes which the globe is perpetually sustaining. The exuviæ of shell and coral animals is perpetually adding to the mass of its earths, and laying a foundation for new islands and numerous beds of limestone in which we very often perceive impressions of the shells from which the soil has originated. On the other hand, we observe numerous quantities of vegetables, both submarine and superficial, heaped and deposited together by currents or other causes, constituting distinct strata, which progressively become decomposed, lose their organization, and confound their own principles with those of the earth's. Hence the origin of pitcoal, and secondary schists or slates; to which, however, the decomposition of animal substances has also largely contributed. Hence, too, the formation and extrication of a variety of acids and alkalis, which have essentially administered to the actual phænomena of the face of the earth.

The action of volcanoes has contributed much in all ages, and is still contributing in our own, to the present state of the earth's surface. We have daily proofs of the mountains which it has elevated, and have already noticed it as one source of the numerous islands that stud the face of the ocean; and we have just adverted to the subterranean agencies of electricity, heat, water, and other gases and fluids which form its fuel. But the operation of volcanoes is more limited and local than that of the preceding agents. "They accumulate substances," says M. Cuvier, "on the surface that were formerly buried deep in the bowels of the earth, after having changed or modified their nature or appearances, and raise them into mountains; but they have never raised up nor overturned the strata through which their apertures pass, and have in no degree contributed to the elevation of the great mountains, which are not volcanic."

Inundations of seas and rivers have also, from time to time, added their tremendous force; but there is no ground for concluding that any catastrophe of this kind has been universal for the last four thousand years; nor, in fact, that such an event has ever occurred more than once since the earth has been rendered habitable.

In examining, then, the merits of the antagonist systems of geology before us, the Plutonic is perhaps best entitled to the praise of boldness of conception and unlimited extent of view. It aspires, in many of its modifications, not only to account for the present appearances of the earth.

but for that of the universe; and traces out a scheme by which every planet, or system of planets, may be continued indefinitely, and perhaps for ever, by a perpetual series of restoration and balance.

With this system the Neptunian forms a perfect contrast. It is limited to the earth, and to the present appearances of the earth. It resolves the genuine origin of things into the operation of water; and while it admits the existence of subterranean fires to a certain extent, and that several of the phænomena that strike us most forcibly may be the result of such an agency, it peremptorily denies that such an agency is the sole or universal cause of the existing state of things, or that it could possibly be rendered competent to such an effect.

More especially should we feel disposed to adhere to this theory, from its general coincidence with the geology of the Scriptures. The Mosaic narrative, indeed, with bold and soaring pinions, takes a comprehensive sweep through the vast range of the solar system, if not through that of the universe; and in its history of the simultaneous origin of this system touches chiefly upon geology, as the part most interesting to ourselves; but so far as it enters upon this doctrine, it is in sufficiently close accordance with the Neptunian scheme,—with the great volume of nature as now cursorily dipped into. The narrative opens, as I had occasion to observe in the lecture On Matter and a Material Word, with a statement of three distinct facts, each following the other in a regular series, in the origin of the visible world. First, an absolute creation, as opposed to a mere remodification of the heaven and the earth, which constituted the earliest step in the creative process. Secondly, the condition of the earth when it was thus primarily brought into being, which was that of an amorphous or shapeless waste. And, thirdly, a commencing effort to reduce the unfashioned mass to a condition of order and harmony. "In the beginning," says the sacred historian, "God CREATED the heaven and the earth.—And the earth was WITHOUT FORM AND VOID: and darkness was upon the face of the deep (or abyss.)—And the spirit of God MOVED upon the FACE OF THE WATERS."

We are hence, therefore, necessarily led to infer that the first change of the formless chaos, after its existence, was into a state of universal aqueous solution; for it was upon the surface of the waters that the Divine Spirit commenced his operative power. We are next informed, that this chaotic mass acquired shape, not instantaneously, but by a series of six distinct days, or GENERATIONS, (that is epochs,) as Moses afterwards calls them;* and apparently through the agency of the established laws of gravity and crystallization, which regulate it at the present moment.

It tells us, that during the first of these days, or generations, was evolved, what, indeed, agreeably to the laws of gravity, must have been evolved first of all, the matter of light and heat; of all material substances the most subtle and attenuate; those by which alone the sun operates and has ever operated, upon the earth and the other planets, and which may be the identical substances that constitute his essence.† And it tells us, also, that the luminous matter thus evolved produced light without the assistance of the sun or moon, which were not set in the sky or firmament, and had no rule till the fourth day or generation: that the light thus produced flowed by tides, and alternately intermitted, constituting a single day and a single night of each of such epochs or generations, whatever their length might be, of which we have no information communicated to us.

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* Gen. ii. 4.

† Herschel, Phil. Trans. vol. lxxxiv.

It tells us, that during the second day or generation uprose progressively the fine fluids, or waters, as they are poetically and beautifully denominated, of the firmament, and filled the blue ethereal void with a vital atmosphere. That during the third day or generation the waters more properly so called, or the grosser and compacter fluids of the general mass, were strained off and gathered together into the vast bed of the ocean, and the dry land began to make its appearance, by disclosing the peaks or highest points of the primitive mountains ; in consequence of which a progress instantly commenced from inorganic matter to vegetable organization, the surface of the earth, as well above as under the waters, being covered with plants and herbs, bearing seeds after their respective kinds ; thus laying a basis for those carbonaceous materials, the remains of vegetable matter, which we have already observed are occasionally to be traced in some of the layers or formations of the class of primitive rocks, (the lowest of the whole,) without a single particle of animal relics intermixed with them.

It tells us, that during the fourth day, or epoch, the sun and moon, now completed, were set in the firmament, the solar system was finished, its laws were established, and the celestial orrery was put into play ; in consequence of which the harmonious revolutions of signs and of seasons, of days and of years, struck up for the first time their mighty symphony. That the fifth period was allotted exclusively to the formation of the water-fowl, and the countless tribes of aquatic creatures ; and, consequently, to that of those lowest ranks of animal life, testaceous worms, corals and other zoophytes, whose relics, as we have already observed, are alone to be traced in the second class of rocks or transition-formations, and still more freely in the third or horizontal formations ; these being the only animals as yet created, since the air and the water, and the utmost peaks of the loftiest mountains, were the only parts as yet inhabitable. It tells us, still continuing the same grand and exquisite climax, that towards the close of this period the mass of waters having sufficiently retired into the deep bed appointed for them, the sixth and concluding period was devoted to the formation of terrestrial animals ; and, last of all, as the masterpiece of the whole, to that of man himself.

Such is the beautiful, but literal progression of the creation, according to the Mosaic account, as must be perceived by every one who will carefully peruse it for himself.

Of the extent, however, of the DAYS OR GENERATIONS that preceded the formation of the sun and moon, and their display in the sky or firmament it gives us, as I have just observed, no information whatever. We only know that the flow of luminous matter which measured them advanced or was kindled up by regular tides ; so that it alternately appeared and disappeared, commencing with a dawn and terminating with a dusk of darkness ; for at the close of each it is said, " and the evening and the morning were the first day :" or, more literally, as indeed suggested in the marginal reading of our national version, " and there was evening and there was morning the first day ;" that is, there was dusk and dawn, and by no means such an evening and morning as we have at present. And hence, Origen observes, that " no one of a sound mind can imagine there was an evening and a morning during the three first days without a sun."[*] So that the passage should, perhaps, be rendered, as most strictly it might

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[*] Περι 'Αρχον: in loc.

be, "and there was dusk AS there was dawn, the first day."—יום אחר
ויחי ערב ויחי בקר.

It has, indeed, been contended that each of these periods constituted a solar day, or a revolution of the earth round its own axis, and consequently answered to the measure of twenty-four hours as at present. But to maintain this opinion it is necessary to suppose, that the sun and the moon were set in the sky "to rule over the day and over the night,"—"to divide the light from the darkness,"—and to "be for signs, and for seasons, and for days, and for years," on or before the very first day or generation; for otherwise there could be no solar day, or such as we have at present, produced by a revolution of the earth round her own axis. And there have not been wanting cosmologists and critics, as Whiston and Rosenmüller, who have maintained that the sun and the moon were created antecedently to the earth; that they had their stations allotted them in the heavens, and actually produced solar days and diurnal revolutions of the earth from the first. But though their own hypotheses require this, the idea is directly opposed to the spirit and the letter of the Mosaic narrative, and hence can in no respect be acceded to by any one who is anxious to preserve this narrative in its integrity and simplicity.

How much more explanatory and pertinent is the remark of our own excellent Bishop Hall, when speaking of the primæval light, that during the first three days illuminated the face of nature: "Not," says he, "of the sun or stars, WHICH WERE NOT YET CREATED; but a common brightness only, to distinguish THE TIME, and to remedy the former confused darkness." And how admirably to the same effect does Bishop Beveridge thus express himself: "When he said, *let there be light*, by that word the light, WHICH WAS NOT BEFORE, BEGAN TO BE. But when he said, (that is, three days or generations afterwards,) *let there be lights in the firmament, to divide the day from the night*, he thereby GAVE LAWS TO THE LIGHT he had before made, where he would have it BE, and what he would have it DO. This is what we call the law of nature: that law which God hath put into the nature of every thing; whereby it always keeps itself within such bounds, and acts according to such rules as God hath set it, and by that means shows forth the glory of his wisdom and power."

Nothing, indeed, can be clearer, than that, according to Moses, the sun and the moon were only set in the heavens during the fourth day or generation in the work of creation; and that, whatever may be the relative proportion of the times and the seasons, the light and the darkness, the day and the night, that have occurred subsequently, we have no reason to suppose they occurred in the same proportion antecedently; since we are expressly told by the same inspired writer, that their immediate office, on being set in the sky, was to RULE these divisions of time, as they have ruled them, with a single miraculous exception or two, ever since, and to divide the light from the darkness, as it has since been divided.

We have no knowledge whatever, therefore, of the length of the first three or four DAYS OR GENERATIONS that marked the great work of creation antecedently to the completion of the sun and moon, and their appointment to their respective posts. And hence, for all that appears to the contrary, they may have been as long as the Wernerian system, and the book of nature, and I may add the term GENERATIONS, employed by Moses himself, seem to indicate.

Nor let it be supposed for a moment, that the term *day* in the Hebrew tongue seems to demand a limitation to the period of four-and-twenty hours, as it ordinarily imports: for there is no term in any language that is used with a wider latitude of construction than the Hebrew יום (*jom*), or its Arabic form, which is the word for day in the original. We are constantly, indeed, employing this very word, as Englishmen, with no small degree of freedom, in our own age; for you will all allow me to drop the phrase "in our own AGE," and to adopt "in our own DAY" in its stead; thus making AGE and DAY terms of similar import. But in Hebrew the same term is employed, if possible, in a still wider range of interpretation: for it not only denotes, as with ourselves, half a diurnal revolution of the earth, or a whole diurnal revolution, but in many instances an entire year, or revolution of the earth round the sun; and this not only in the prophetic writings, which are often appealed to in support of this remark, but in plain historical narrative as well. Thus in Exod. xiii. 10, the verse, "thou shalt keep this ordinance in its season *from year to year*," if literally rendered, would be "*through days of days*," or "through *days upon days*,"—מימים ימימה. And in like manner, Judges xvii. 16, "I will give thee ten *shekels* of silver *by the year*," if strictly interpreted, would be "*per dies—for the days*," —that is, "for the ANNUAL CIRCLE of days,"—לימים.

Sometimes, again, the Hebrew יום, or day, comprises the whole term of life, as in 1 Chron. xxix. 15.

> **Our DAYS (ימיכן) on earth are a shadow,**
> **And there is none abiding.**

So again, Job xiv. 6.

> **Turn from him that he may rest,**
> **Till he shall accomplish, as a hireling, his DAY—יומן.**

But the clearest and most pertinent proof of the latitude with which the term יום, or DAY, is employed in the Hebrew scriptures, is in the very narrative of the creation before us: for after having stated in the first chapter of Genesis that the work of creation occupied a period of SIX DAYS, the same inspired writer, in recapitulating his statement, ch. ii. 4, proceeds to tell us, "these are,"—or rather, "*such were* the GENERATIONS of the heavens and of the earth when they were created; IN THE DAY (ביום) that the Lord God made the earth and the heavens." In which passage Moses distinctly tells us, that, in the preceding chapter, he has used the term יום DAY in the sense of generation, succession, or epoch; while we find him here extending the same term DAY to the whole hexaemeron, the entire term of time, whatever it may be, that these six days or generations filled up. So that the sense given to the word by Moses, instead of limiting us to the idea of twenty-four hours' duration, naturally leads us to ascribe, not only a different, but a much enlarged extent of time to the divisions he has marked by the word יום, or DAY: or at least to those terms which occurred before the government of the sun and the moon was established, and the heavenly orrery commenced its harmonious action.

Whether, indeed, the days from this last period, constituting the fifth and sixth, were of a different length from any of the preceding, which may also have differed from each other, and were strictly diurnal revolutions of twenty-four hours, it is impossible exactly to determine. But it is a question which by no means affects the actual face of nature or the geological system before us: for as the third or horizontal series of rocks in which petrifactions of KNOWN animal and vegetable substances begin to make their appearance must have continued to augment for ages after the completion of the hexaemeron, or six epochs of creation, whatever be the duration assigned to them; and as the two loftiest, the fourth and fifth sets of rocks, or the alluvial and volcanic, are still forming, and have been ever since the great work of creation was completed, the precise duration of the two last days of creative labour can have no influence upon this question. But to a plain yet attentive reader of the Mosaic account even these two days must, I think, appear to have been of a far more protracted length than that of twenty-four hours each, and especially the sixth day; for it is difficult to conceive how the first parent of mankind could have got through the vast extent of work assigned to him within the short term of twelve or fourteen hours of daylight, without a miracle, which is by no means intimated to us, and as difficult to suppose that he was employed through the night. On this last day were created, as we learn from Gen. i. 24—28., all the land-animals after their kind, cattle, and wild beasts and reptiles; then Adam himself, but alone; who was next, as we learn from ch. ii. 15—22., taken and put into the garden of Eden, *to dress it and to keep it;* where he had explained to him the trees he might eat of, and the tree he might not; after which were brought to him, that he might make himself acquainted with their respective natures, every beast of the field and every fowl of the air; to all of whom he gave names as soon as their respective characters became known to him. Subsequently to which (for at this time, v. 20; there was not found a help meet for him) he was plunged into a deep sleep, when the woman was formed out of a part of himself, which completed the creative labour of this last day alone.

That the same Almighty Power who created light by a word, saying אור יהי אור ריהי "be light! and light was"* could have ruled the whole of this, or even formed the universe, by a word, as well, is not to be doubted; but as both the book of revelation and the book of nature concur in telling us that such was not the fact, and that the work of creation went on progressively, and under the influence of a code of natural laws, we are called upon to examine into the march of this marvellous progress by the laws of nature referred to, and to understand it by their operations. Nor is it more derogatory to Him with whom a thousand years are as one day, and one day as a thousand years, to suppose that he allotted six hundred or six thousand years to the completion of his design, than that he took six solar days for the purpose; and surely there is something far more magnificent in conceiving the world to have gradually attained form, order, and vitality, by the mere operation of powers communicated to it in a state of chaos, through a single command, which instantly took effect and commenced, and persevered and perfected the design proposed, than in conceiving the Almighty engaged in personal and continuous exertions, though for a more limited period of time.

Thus, in progressive order, uprose the stupendous system of the world: the bright host of morning stars shouted together on its birth-day; and the eternal Creator looked down with complacency on the finished fabric, and saw "that it was good."

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* Gen. i. 3.

LECTURE VIII.

ON ORGANIZED BODIES, AND THE STRUCTURE OF PLANTS COMPARED WITH THAT OF ANIMALS.

From the unorganized world, which has formed the main subject of our two last lectures, let us now rise a step higher in the scale of creation; and ascend from insentient matter to life, under the various modifications it assumes, and the means by which it is upheld and transmitted.

If I dig up a stone, and remove it from one place to another, the stone will suffer no alteration by the change of place; but if I dig up a plant and remove it, the plant will instantly sicken, and perhaps die. What is the cause of this difference? Both have proceeded from a minute molecule, a nucleus or a germ; both have a tendency to preserve their derivative or family configuration, and both have been augmented and perfected from one common soil. If I break the stone to pieces, every individual fragment will be found possessed of the characteristic powers of the aggregate mass; it is only altered in its shape and magnitude; but if I tear off a branch from the plant, the branch will instantly wither, and lose the specific properties of the parent stock.

No external exemination, or reasoning *à priori*, will explain this difference of effect. It is only by a minute attention to the relative histories, interior structures, and modes of growth of the two substances, that we are enabled to offer any thing like a satisfactory answer; and by such examination we find that the stone has been produced fortuitously, has grown by external accretion, and can only be destroyed by mechanical or chemical force; while the plant has been produced by generation, has grown by nutrition, and been destroyed by death: that it has been actuated by an internal power, and possessed of parts mutually dependent and contributory to each other's functions.

In what this internal power consists we know not. Differently modified, we meet with it in both plants and animals; and wherever we find it we denominate it the *principle of life*, and distinguish the individual substance it actuates by the name of an *organized being*. And hence, all the various bodies in nature arrange themselves under the two divisions of organized and unorganized; the former possessing an origin by generation, growth by nutrition, and a termination by death; and the latter a fortuitous origin, external growth, and a termination by chemical or mechanical force.

This distinction is clear, and it forms a boundary that does not seem to be broken in upon by a single exception. In what, indeed, that wonderful power of crystallization consists, or by what means it operates, which gives a definite and geometrical figure to the nucleus or primary molecule of every distinct species of crystal; and which, with an accuracy that laughs at all human precision, continues to impress the same figure upon the growing crystal through every stage of its enlargement, thus naturally separating one species from another, and enabling us to discriminate each by its geometrical shape alone—we know not: but even here, where we meet with an approach towards that formative effort, that internal action and consent of parts which peculiarly characterize the living substance, there is not the smallest trace of an organized arrangement; while the origin is clearly fortuitous, and the growth altogether external, from the mere apposition of surrounding matter.

So, on the other hand, in corals, sponges, and fuci, which form the lowest natural orders among animals and vegetables, and the first of which seems to constitute the link that connects the animal and vegetable with the mineral world, for it has in different periods been ascribed to each,—simple as is their structure, and obtuse as is the living principle that actuates them, we have still sufficient marks of an organized make; of an origin by generation, the generation of buds or bulbs, of growth by nutrition, and of termination by death.

But the animal world differs from the vegetable as widely as both these differ from the mineral. How are we to distinguish the organization of animals from that of plants?—In what does their difference consist? And here I am obliged to confess, that the boundary is by no means so clearly marked out; and that we are for the most part compelled to characterize the difference rather by description than by definition. Nothing, indeed, is easier than to distinguish animals and vegetables in their more perfect states: we can make no mistake between a horse and a horse-chesnut tree, a butterfly and a blade of grass. We behold the plant confined to a particular spot, deriving the whole of its nutriment from such spot, and affording no mark either of consciousness or sensation; we behold the animal, on the contrary, capable of moving at pleasure from one place to another, and exhibiting not only marks of consciousness and sensation, but often of a very high degree of intelligence as well. Yet, if we hence lay down consciousness or sensation, and locomotion, as the two characteristic features of animal life, we shall soon find our definition untenable; for while the Linnéan class of worms affords instances, in perhaps every one of its orders, of animals destitute of locomotion, and evincing no mark of consciousness or sensation, there are various species of plants that are strictly locomotive, and that discover a much nearer approach to a sensitive faculty.

However striking, therefore, the distinctions between animal and vegetable life, in their more perfect and elaborate forms, as we approach the contiguous extremities of the two kingdoms we find these distinctions fading away so gradually,

> Shade, unperceived, so softening into shade,

and the mutual advances so close and intimate, that it becomes a task of no common difficulty, to draw a line of distinction between them, or to determine to which of them an individual may belong. And it is probable, that that extraordinary order of beings called zoophytes, or animated plants, as the term imports, and which by Woodward and Beaumont were arranged as minerals,* and by Ray and Lister as vegetables, have at last obtained an introduction into the animal kingdom,† less on account of any other property they possess, than of their affording, on being burnt, an ammoniacal smell like that which issues from burnt bones, or any other animal organs, and which is seldom or never observed from burnt vegetable substances of a decided and unquestionable character. Ammonia, however, upon destructive distillation, is met with in small quantities in *particular parts* of most if not of all vegetables, though never perhaps in the whole plant. Thus it occurs slightly in the wood or vegetable fibre; in extract, gum-mucilage, camphor, resin, and balsam; gum-resin, gluten, and caoutchouc: besides those substances that are common to both animals and vegetables, as sugar, fixed oil, albumen, fibrine, and gelatine. There are some plants, however, that even in their open exposure to a burning heat, give forth an ammoniacal smell closely approaching to that of animal substance. The clavarias or club-tops, and many other funguses, do this. But a distinction in the degree of odour may even here be observed, if accurately attended to. Yet the clavarias were once regarded as zoophytes, and are arranged by Millar in the same division as the corals and coral-lines.[*]

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* Phil. Trans. xiii. 277.

† Parkinson's Organic Remains, i. 23, ii. 157, 158.

M. de Mirbel, in his very excellent treatise "On the Anatomy and Physiology of Plants," has endeavoured to lay down a distinction between the animal and the vegetable world in the following terms, and it is a distinction which seems to be approved by Sir Edward Smith: "Plants alone have a power of drawing nourishment from inorganic matter, mere earths, salts, or airs; substances incapable of nourishing animals, which only feed on what is or has been organized matter, either of a vegetable or animal nature. So that it should seem to be the office of vegetable life alone to transform dead matter into organized living bodies."[†] Whence another learned French physiologist, M. Richerand, has observed that the aliments by which animals are nourished are selected from vegetable or animal substances alone; the elements of the mineral kingdom being too heterogeneous to the nature of animals to be converted into their own substance without being first elaborated by vegetable life; whence plants, says M. Richerand, may be considered as the laboratory in which nature prepares aliments for animals.[‡]

I concur with these elegant writers in admitting the beautiful and harmonious relation so obviously established between minerals, plants, and animals; but it is at the same time impossible to allow of the distinction between vegetable and animal life here laid down; because, first, vegetables are by no means nourished exclusively, as indeed M. Mirbil himself frankly allows, from terrene elements: and secondly, because animals are as little nourished exclusively from vegetable materials. Among insects, worms, and even fishes, there are many tribes that derive by far the greater portion of their increase from the mineral kingdom alone; while even in man himself, air, water, common salt, and lime, which last is almost always an ingredient of common salt, are substances indispensable to his growth, and are derived immediately from the mineral kingdom.

In laying down, therefore, a distinctive character for animals and plants, we are compelled to derive it from the more perfect of each kind: and to leave the extreme cases to be determined by the chemical components eliminated on their decomposition. And under this broad view of the subject I now proceed to observe, that while they agree in an origin by generation, a growth by nutrition, and a termination by death; in an organized structure, and an internal living principle; they differ in the powers with which the living principle is endowed, and the effects it is capable of exerting. In the plant it is limited, so far as we are capable of tracing it, to the properties of irritability, contractility, and simple instincts; in the animal it superadds to these properties those of muscularity, sensation, and voluntary motion.

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[*] Several species of this genus of fungi have very singular properties: thus, the c. *hæmatodes* has so near a resemblance to tanned leather, though somewhat thinner and softer, as to be named *oak-leather club-top*, from its being chiefly found in the clefts and hollows of oak-trees. In Ireland, it is employed as leather to dress wounds with; and, in Virginia, to spread plasters upon.

There are some cryptogamic plants, and especially among the mosses, that can be hardly made to burn by any means. Such is the fontinella *antipyretica*, so called on this very account; and which is hence in common use among the Scandinavians, as a lining for their chimney-sides, and the inside of their chimneys, by way of preservation. So that here we have an approach to mineral instead of to animal substances, and especially to the asbestos and other species of talcose earths. There is one species of byssus, another curious genus of mosses, that takes the specific name of asbestos, from this very property. It is found in the Swedish copper mines of Westmann-land in large quantities; and when exposed to a red heat, instead of being consumed, is vitrified.

[†] Traite d'Anatomie et de Physiologie vegetale. i. 19.

[‡] Elemens de Physiologie, &c. cap de la Digestion.

There have been, indeed, and there still are, physiologists who,—not adverting to the extraordinary effects which the power of irritability is capable of producing when roused by different stimulants, and under the influence of an internal and all-pervading principle of life, operating by instinctive laws and instinctive actions, or those, as we shall show hereafter, which are specially directed to the growth, preservation, or reproduction of a living frame, or any particular part of it,—have conceived plants as well as animals to be possessed of sensation and muscular fibres; and as sensation is the result of a particular organ, and the organ producing it is connected with various others, have at the same time liberally endowed them with a brain, a heart, and a stomach; and have very obligingly permitted them to possess ideas, and the means of communicating ideas; to fall in love and to marry, and thus far to exercise the distinctive faculty of volition. The whole of which, however, is mere fancy, grounded altogether upon an erroneous and contracted view of the effects of the principle of irritability when powerfully excited by the influence of light, heat, air, moisture, and other causes.

In reality, such kinds of loves and intermarriages are not peculiar to plants, but are common to all nature: they exist between atom and atom, and the philosopher calls them attractions; they exist between congeries and congeries, and the chemist calls them affinities; they exist between the iron and the loadstone, and every one denominates them magnetism. Nor let it be said that in these cases of mutual union we have nothing more than a mere aggregation of body; for we have often a third substance produced, and actually generated, as the result of such union, far more discrepant from the parent substances both in quality and feature than are ever to be met with in vegetable or animal life. Thus if an acid be married to an alkali, the progeny brought forth will be a neutral salt, possessing not the remotest resemblance to the virtues of either of its parents. In like manner if alkohol be married to any of the more powerful acids, and the banns be solemnized over an altar of fire, but not otherwise, the offspring engendered will be a substance called ether, equally unlike both its parents in its disposition. But the form or features are as frequently changed as the temper. Thus, if we unite olive oil, which is a liquid, with some of the oxydes of lead, which are powders, the result is neither a liquid nor a powder, nor a medium of the two, which would be a paste, but the hard adhesive plaster usually called diachylon. So, again, if muriatic acid, which is a liquid, sport in dalliance with the volatile nymph ammonia, which is an invisible gas, the fruit of their embraces will be still more extraordinary in point of form, for the gas and the liquid will engender that solid substance commonly known by the name of sal ammoniac, or, in the new nomenclature, muriate of ammonia. In like manner our common smelling salts, or carbonate of ammonia, though a hard concrete crystallization, are the mere result of the union of two invisible gases, ammonia and carbonic acid gas, or fixed air; and which, having duly paid their court to each other, give birth to this solid substance.

But in all this it may be said that we have no instance of a multiplication of species; nor in reality of any thing more than the production of a third substance, issuing, like the fabled phœnix of antiquity, out of the ashes or decomposition of the parent stock; yet in many cases we have instances of multiplication also—and instances far more extraordinary and far more prolific than are ever to be found in the multiplication of either animals or vegetables. Such especially, are those wonderful increases that occur in the case of ferments and of contagions. A few particles of yeast lying dormant in a dessert-spoon are introduced into a barrel of beer, or of any other fermentable fluid, and in a few hours propagate their kind through the largest vessel that was ever manufactured; so that at length every particle of the fluid is converted into a substance of their own nature. A few pestilential miasms are thrown forth from a stagnant marsh or a foul prison, and give birth instantaneously to myriads and myriads of the same species of particles, till the atmosphere becomes impregnated with them through a range of many miles in diameter. Two or three particles of the matter of plague are packed up in a bag of cotton at Aleppo, and are many months afterwards set at liberty in Great Britain. Aided by the stimulus of the air, they instantly set to work, and procreate so rapidly that the whole country in less than a week is laid prostrate by the enormity of their increase.

Now the terms loves and marriages will just as well apply to all these as to the vegetable creation. The cause of the respective unions, and of the changes that take place in consequence of such unions, are in both cases nothing more than elective attractions: in the mineral and gaseous kingdoms produced by what chemists have denominated the principle of *affinity*, and in the vegetable by what physiologists have called the principle of *irritability;* a principle far nicer and nobler and more delicate than that of affinity, and under the influence of an internal, an all-pervading and identifying vital power, capable, as differently excited by different stimulants, of producing far nicer and nobler, more delicate and more complicated effects; but which in itself is not more different from the principle of *affinity* than it is from that of *sensation.*

No experiment or observation has hitherto proved vegetables to be possessed of any higher powers than those of irritability, contractility, and those instinctive energies which we shall hereafter show are dependent upon the principle of life.

It is almost superfluous to observe, in this place, that there are also powers and faculties of a much higher character than any I have yet noticed, appertaining to the nobler ranks of animals; for at present I am only pointing out the leading characters by which animals in general may be distinguished from vegetables in general, and shall have sufficient opportunities, as we proceed, of adverting to these additional faculties, and of investigating their respective excellencies.

Our immediate concern, then, is with VEGETABLE LIFE: its general laws, structure, and phænomena. And upon this subject I shall touch as briefly as possible, intending it as a mere vestibule, or introduction to the more important study of animal philosophy.

Plants, then, like animals, as I have already observed, are produced by generation, and through the medium of ova, or eggs. The exceptions to this common rule are few, and they occur equally in both kingdoms. The egg of the plant is its seed: a doctrine not of modern origin, but taught and understood quite as clearly, and with as close a reference to the rise of animal life, by the ancients, as in the present day.* The seed is sometimes naked, but more generally covered with a pericarp, whence plants become naturally divided into the two grand arragements of gymnospermous, and angiospermous. The pericarp is of various forms and structures; and of these the more common are the legume, silique, or silicle, being merely varieties of what, among ourselves, is denominated in popular language cod or pod; the loment, which is a kind of pod not so frequent as either of the former, but of which we have an instance in the mimosas and the cassia ***Fistula;*** the pome or core-apple, of which we have instances in the common apple and the pear; the drupe, or stone-apple, instances of which occur to us in the plum, cherry, and almond; the glume or chaff; the berry; the acinus or conglomerate berry, as in the rasp; the nut; and the capsule.†

Stripping off this outer covering, we find the seed to consist internally of a *corculum*, or heartlet, and externally of a fleshy or parenchymatous substance, surrounded with a double integument, sometimes single, sometimes bifid, and sometimes more than bifid; and hence denominated monocotyledonous, dicotyledonous, polycotyledonous. In popular language these are called seed-lobes, or seed-leaves: and in the phaseolus ***vulgaris***, or common kidney-bean, we have as striking an instance as in any plant, and which every one must have noticed, just peeping in two distinct segments above the ground, as soon as the seed has begun to germinate. It was very generally supposed formerly, and is still supposed by some botanists, that the seeds of various orders of plants, as the mosses, fungi, and algæ, are acotyledonous, or totally destitute of a cotyledon of any kind. But as many, perhaps most, plants of this kind have of late been found to possess some such parenchyma, we have great reason for believing that this organ is universal, and that there is no such thing as an acotyledonous seed in the whole vegetable kingdom. In reality, the cotyledon appears absolutely necessary for the germination and future growth of the seed, and may hence be denominated its lungs or placentule. Like the perfect plant, it possesses lymphatics and air vessels. Through the former of these it absorbs the moisture of the soil into which it is plunged, decomposes a part of it into its elementary principles, and conducts those principles, together with the undecomposed water, to the corcle or heartlet, which becomes stimulated to the process of germination by the oxygene thus set at liberty.

Mrs. Ibbetson has attempted to prove that the cotyledon is of no use whatever for the purpose of nourishment; which, according to her observations, is only conveyed to the corcle by what she calls a system of nourishing vessels, altogether distinct from the cotyledon. It is not very clear, however, what is here meant, by nourishing vessels; nor can we for a moment admit that so large an organ as the cotyledon, and apparently so important, can be designed for no other office, than merely, as this lady conjectures, to screen the primordial leaves from the light and air on their first formation.*

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* *ʽΟυτω δ’ ’ωοτοκει μικρα δενδρεα πρωτον ελαιας*
Empedocles.

So plants, like animals, uprise to air,
And in green eggs young olives olives bear.

And upon this beautiful verse, which he has preserved as a fragment, Aristotle remarks, *το τε γαρ ωον κυημα εστι, και εκ τινος αυτου γιγνεταιν το ζωον.* "For the egg is the conception, and after the same manner the animal is created." *De Generat. Animal.* i. 23.

† Compare Knight's general theory of vegetable physiology, Horticultural Transactions, vol. i. p. 217. with Nicholson's Journal, vol. xxxii. p. 350.

According to Mr. Mirbel's experiments, as detailed in the Memoirs of the National Institute, the soil and the albumen in the cotyledon are both concerned in the developement of the germ; and both continue to contribute conjointly till the albumen is entirely absorbed: at which time the plant has strength enough to derive from the soil or the atmosphere the nourishment it requires from this period. In this respect the albumen of the cotyledon corresponds with the vitellus of the hen's egg.

In marine plants that are destitute of a radicle, as the water caltrop (trapa *natans*,) the germ must necessarily be supported in the first instance by means of the cotyledon.

It is the corcle which is the true *punctum saliens* of vegetable life, and to this the cotyledon is subservient. The corcle consists of two parts, an ascending and a descending; the former called its plumule, which gives birth to the trunk and branches; the latter named its rostel, which gives birth to the root and radicles. The position of the corcle in the seed is always in the vicinity of the *hilum* or eye, which is a cicatrix or umbilicus remaining after the separation of the *funis* or umbilical cord from the pericarp, to which the seed has hereby been attached. The first radicle or germinating branch of the rostel uniformly elongates and pushes into the earth, before the plumule evinces any change. Like the cotyledon, the radicles consist chiefly of lymphatics and air-vessels, which serve to separate the water from the soil, in order that the oxygene may be separated from the water.

Hence originates the root, unquestionably the most important part of the plant, and which in some sense may be regarded as the plant itself; for if every other part of the plant be destroyed, and the root remain uninjured, this organ will regerminate and the whole plant be renewed; but if the root perish, the plant becomes lost irrecoverably. Yet there are various phænomena in vegetable life that manifest a smaller difference in the nature of the root and the trunk, than we should at first be induced to suppose; for Willoughby observed, more than a century and a half ago,† that in several species, and especially those of the prunus and salix, cherry and willow tribes, if the stem branches be bent down to the earth, plunged into it, and continued in this situation for a few months, these branches will throw forth radicles; and if, after this, the original root be dug up, and suffered to ascend into the air, so that the whole plant become completely inverted, the original root will throw forth stem-branches and bear the wild fruit peculiar to its tribe. The rhizophora *Mangle*, or mangrove-tree, grows naturally in this manner; for its stem-branches, having reached a certain perpendicular height, bend downwards of their own accord, and throw forth root-branches into the soil, from which new trunks arise, so that it is not uncommon, in some parts of Asia and Africa, to meet with a single tree of this species covering the oozy waters in which it grows with a forest of half a mile in length. The ficus *Indica*, or banyan, grows in the same manner, and often with enormous trunks, equally derived from a primary root. The largest tree of this kind known to Europeans, is on an island in the river Nerbedda in the Guzzerat, distinguished in honour of a Bramin, of high reputation, by the name of Cubbeer Bur. High floods have destroyed many of its incurved stems, yet its principal stems measure two thousand feet in circumference, the number of its larger trunks, each exceeding the bulk of our noblest oaks, amount to three hundred and fifty, while that of its smaller are more than three thousand ; so that seven thousand persons may find ample room to repose under its enormous shade, and may at the same time be richly supplied from the vast abundance of fruit which it yields in its season.

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* Nicholson's Journal, vol. xxvii. 9.

† Phil. Trans. year 1669, iv. p. 963.—1670, v. p. 1165. 1168. 1199.—1671. vi. p. 2119.

The solid parts of the trunk of the plant consist of CORTEX, cuticle, or outer bark ; LIBER, CUTIS, or inner bark ; ALBURNUM, or soft wood ; LIGNUM, or hard wood ;* and MEDULLA, or pith. Linnéus gave the name of medulla to the pith of plants, upon a supposition that it had a near resemblance to the medulla spinalis of quadrupeds. A closer investigation, however, has since proved that this resemblance is very faint, and that the pith or medulla of vegetables consists of nothing more than a mere spongy cellular substance, forming indeed an admirable reservoir for moisture ; and hence of the utmost importance to young plants, which in consequence of their want of leaves and branches whose surfaces are covered with the bibulous mouths of innumerable lymphatics, would otherwise be frequently in danger of perishing through absolute drought ; but gradually of less use as the plant advances in age, and becomes possessed of these ornamental appendages ; and hence, except in a few instances, annually encroached upon, and at length totally obliterated by the surrounding lignum.

All these lie in concentric circles ; and the trunk enlarges, by the formation of a new liber or inner bark every year ; the whole of the liber of one year, excepting indeed its outermost layer, which is transformed into cortex, becoming the alburnum of the next, and the alburnum becoming the lignum. Such, at least, is the common theory, and which seems to be well supported by the experiments of Malpighi and Grew : but it has lately been controverted by Mr. Knight, who contends, that the liber has no concern in the formation of new wood, which proceeds from the alburnum alone, a new layer of alburnum being formed for this purpose annually. I cannot discuss the argument at present : nor is it of any great importance ; since, under either system, it is obvious that a mark of any kind which has penetrated through the outer into the inner bark, must in a long process of years be comparatively transferred to the central parts of the trunk. On which account we often find, in felling trees of great longevity, as an oak, for example, the date of very remote national æras, and the initials of monarchs who flourished in very early periods of our national history, stamped in the very heart of the timber on its being subdivided.

Some of these memorials are very curious, and M. Klein, the well-known Secretary of Dantzic, has given various examples in his letter to Sir Hans Sloane, bart., the President of the Royal Society.† One of these consists of a long series of letters discovered, in 1727, in the trunk of a full-grown beach, near Dantzic, in land belonging to the family of Daniel Berckholtz. The letters D. B. were chiefly conspicuous in the solid wood; the wood towards the bark, and that towards the heart, that is, in each extremity, "bearing not the least trace of letters." M. Klein relates another example from the Ephemerides of Natural Curiosities,* recorded by Joannes Myerus. It consists of a thief hanging from a gibbet, apparently drawn by nature's own pencil in the timber of a beech-tree: as also the figure of a crucified man, found in a tree of the same kind; and that of a chalice with a sword, perpendicularly erect, sustaining a crown on its point; which was preserved at the Hague, and had been seen by himself.

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* There is a curious paper of Count Rumford's mentioned among the labours of the French Imperial Institute for 1812, upon the chemical properties of the different parts entering into the composition of the trunk of trees, for an account of which see also Thomson's Annals of Philos. vol. i. p. 386. By a variety of experiments Count Rumford was led to this singular conclusion, that the specific gravity of the solid matter which constitutes the *timber* of wood is almost the same in all trees. By the same means he determined that the woody part of oak in full vegetation is only four-tenths of the whole. Air constitutes one-fourth of it, and the rest consists in sap. Light woods have still a much less quantity of solid matter : but the season of the year and the age of the tree occasion considerable variations. Ordinary dry wood contains about one-fourth of its weight of water. Even the oldest wood, though in the state of timber for ages, never contains less than one-sixth of its weight of water. All absolutely dry woods give from 42 to 43 per cent. of charcoal : whence he concludes, that the ligneous matter is identic in all woods.

† Phil. Trans. for 1739, vol. xli. p. 231.

Such marks were formerly attributed to miraculous intervention, or regarded as marvellous sports of nature: but the hints now offered will easily explain their origin.

Foreign substances have often been found imbedded in the same way, having at one time been sunk into the inner bark, or penetrated it by a wound or other excavation, and afterwards covered over with new annual growths of liber and alburnum. Thus Sir John Clerk gives an account of a horn of a large deer which was found in the heart of an oak in Whinfield Park, Cumberland, fixed in the timber with large iron cramps, with which, of course, it had been fastened on.† And we are hence able to account for the occasional detection of a capricorn beetle,‡ or other insect which has been found in the centre of a trunk, the animal having crept into an accidental cleft, and either died there naturally, or been arrested and imprisoned by the secretion of the matter of new inner bark while in the torpitude of its aurelian state. And hence, indeed, the cause of the very wonderful phænomena of toads or frogs being at times found in a like situation; having in the same way been impacted in the hole or crack into which they had crept, by the glutinous fluid of the inner bark, during sickness or a protracted winter sleep. Some of these are found alive when the tree is cut down, deriving both air and nutriment enough from the surrounding vessels of the tree during their imprisonment. In the Memoirs of the Paris Academy there is an example of a toad found in a tree that was proved to be a century old.§

As the series of concentric circles, produced in the trunk of a tree by the growth of every year, are still visible after the conversion of every other part into lignum, or hard wood, we can trace its age with a considerable degree of certainty, by allowing a year for every outer circle, and about two or three years for the complete lignification of the innermost.||

Independently of these more solid parts of the trunk or stem, we generally meet with some portion of parenchyma and cellular substance, and always with the different systems of vegetable vessels disposed in one common and uniform arrangement. The lower orders of plants, indeed, such as the annuals and biennials, consist almost exclusively of parenchyma or cellular substance, with an inner and outer bark, and the respective vessels of the vegetable system.

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* Eph. Nat. Cur. decad. iii. an. v. obs. 29.

† Phil. Trans. for 1740, vol. xli. p. 448.

‡ Id. 1741, vol. xli. p. 861.

§ Mem. de l'Acad. Par. 1731, p. 24.

|| The palms form an exception to this general rule, possessing neither proper bark, nor fascicles of vessels displayed in any circular form: the bark being produced by a remnant of the leaves, and the vessels running in a straight line without regular order, and surrounded by cellular substance.

These vessels are adducent and reducent, or arteries and veins, lacteal or sap-vessels, and lymphatics. Many of these may be seen by the naked eye, and especially the sap-vessels: and the vascular structure of the whole has been sufficiently proved by Gessner, by means of the air-pump. The reducent or returning vessels are stated, by Sir E. Smith, to bring back the elaborated sap from the leaves to the liber for the new layer of the existing year.*

The lymphatics lie immediately under the cuticle and in the cuticle. They anastomose in different ways through their minute intermediate branches, and, by surrounding the apertures of the cuticle, perform the alternating economy of inhalation and exhalation. Their direction varies in different species of plants, but is always uniform in the same species.

Immediately below these lie the adducent vessels or arteries; they are the largest of all the vegetable vessels, rise immediately from the root, and communicate nutriment in a perpendicular direction: and, when the stem of a plant is cut horizontally, they instantly appear in circles. Interior to these lie the reducent vessels or veins; which are softer, more numerous, and more minute than the arteries; and in young shoots run down through the cellular texture and the pith. Between the arteries and veins are situated the *air-vessels*, as they were formerly called; but which Dr. Darwin and Mr. Knight have sufficiently succeeded in proving to contain, not air in their natural state, but sap.† They seem to be the true genuine lacteals issuing from the root, as, in animals, they issue from the villous coating of the intestinal canal. They are delicate membranous tubes, stretching in a spiral direction, the folds being sometimes close to each other, and sometimes more distant, but generally growing thicker towards the root, and especially in ligneous plants. These vessels also are very minute, and, according to numerous observations of Hedwig made with the microscope, seldom exceed a 290th part of a line, or a 3000th part of an inch in diameter.

The lymphatics of a plant may be often seen with great ease by merely stripping off the cuticle with a delicate hand, and then subjecting it to a microscope; and in the course of the examination we are also frequently able to trace the existence of a great multitude of valves, by the action of which the apertures of the lymphatics are commonly found closed.‡ Whether the other systems of vegetable vessels possess the same mechanism, we have not been able to determine decisively; the following experiment, however, should induce us to conclude that they do. If we take the stem of a common balsamine,§ or of various other plants, and cut it horizontally at its lower end, and plunge it, so cut, into a decoction of Brazil wood, or any other coloured fluid, we shall perceive that the arteries or adducent vessels, as also the lacteals, will become filled or injected by an absorption of the coloured liquor; but that the veins, or reducent vessels, will not become filled; of course evincing an obstacle, in this direction, to the ascent of the coloured fluid. But if we invert the stem, and in like manner cut horizontally the extremity which till now was uppermost, and plunge it so cut into the same fluid, we shall then perceive that the veins will become injected, or suffer the fluid to ascend, but that the arteries will not: proving clearly the same kind of obstacle in the course of the arteries in this direction, which was proved to exist in the veins in the opposite direction; and which reverse obstacles we can scarcely ascribe to any other cause than the existence of valves.*

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* Introd. to Botany, p. 56. See also Wildenow's Introd. p. 236.

† See Smith's Introd. p. 47.

‡ This seems to acquire additional probability from Mr. Knight's experiments. See Phil. Trans. 1804; and Thomson's Chemistry, v. 385. See Wild. p. 236.

§ Impatiens *balsamina*:—This is the plant recommended by M. Wildenow for this purpose, as affording the clearest results.

By this double set of vessels, moreover, possessed of an opposite power, and acting in an opposite direction, the one to convey the sap or vegetable blood forwards, and the other to bring it backwards, we are able very sufficiently to establish the phænomenon of a circulatory system; and, according to several of the experiments of M. Wildenow, it seems probable that this circulatory system is maintained by the projectile force of a regular and alternate contraction and dilatation of the vegetable vessels. Yet the great minuteness of these vessels must ever render it extremely difficult to obtain any thing like absolute certainty upon this subject. Even in the most perfectly established, circulatory systems of animals, in man himself, it is not once in five hundred instances that we are able to acquire any manifest proof of such a fact: we are positive of the existence of an alternating systole and diastole in the heart, from the pulsation given to the larger arteries when pressed upon; but no degree of pressure produces any such pulsation in the minuter arteries, at least, in a healthy state; yet we have full reason to believe that the same action of the heart extends to the minutest as to the largest arteries. How much less, then, ought we to expect any full demonstration of this point in the vessels of vegetables, in every instance so much more minute than those of the more perfect animals, and seldom exceeding, as I have already observed, a three thousandth part of an inch in diameter!

It becomes me, however, to confess, that no experiments which have hitherto been made have detected the existence of either motific or sensific fibres themselves in vegetables, although very high degrees of galvanic electricity have for this purpose been applied to the most irritable of them, as the dionæa *muscipula*, or Venus fly-trap; oxalis *sensitiva;* different species of drosera, or sun-dew; acacias of various kinds, and other mimosas; and especially the mimosa *pudica*, and *sensitiva*, the common sensitive plants of our green-houses. Humboldt has uniformly failed; Rafn appears to have succeeded in one or two instances, but his general want of success prevents us from being able to lay any weight on the single case or two in which he seems to have been more fortunate.

It should be observed, that the matter of fibrine, or the principle of the muscular fibre, formerly supposed to exist exclusively in animal substances, has lately been detected by M. Vauquelin in vegetables also. Dr. Hales cut off the stems of vines in the spring, and by fixing tubes on the stumps, found that the sap rose in many instances to the height of thirty-five feet. Tubes have been fixed to the large arteries of animals, as near as possible to the heart, in which the blood did not rise higher than nine feet.

It has long been admitted by botanists in general, that the thorns of plants are abortive branches; the scales of buds have, in like manner, been regarded as transformed leaves; and it has lately been conjectured by M. de Candolle, that their petals are not special organs, but stamens in an abortive or transformed state.†

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* Yet Hales and Duhamel seem to have shown, that in the sap-vessels no valves exist; and that branches imbibe moisture nearly equally at either end. See Thomson's Chemistry, v. 385; an assertion, however, opposed by various facts. See also Smith's Introd. p. 57. 60.

† Mem. de la Societe d'Arcueil, tom. iii.

Plants are also possessed of cutaneous secernents or perspiratory vessels; and in many plants the quantity of fluid thrown off by this emunctory is very considerable. Keil, by a very accurate set of experiments, ascertained that in his own person he perspired 31 ounces in twenty-four hours. Hales, by experiments equally accurate, determined that a sun-flower, of the weight of three pounds only, throws off 22 ounces in the same period of time, or nearly half its own weight. To support this enormous expenditure it is necessary that plants should be supplied with a much larger proportion of nutriment than animals; and such is actually the fact. Kiel ate and drank 4 lb. 10 oz. in the twenty-four hours. Seventeen times more nourishment was taken in from the roots of the sun-flower than was taken in by the man.

Plants, nevertheless, do not appear to have the smallest basis for sensation, admitting that sensation is the result of a nervous system; and we are not acquainted with any other source from which it can proceed; notwithstanding that Percival and Darwin, as already observed, have not only endowed them with sensation, but with consciousness also: and the latter, indeed, with a brain, and the various passions and some of the senses to which this organ gives birth.*

Yet though the vessels of plants do not appear to possess any muscular fibres, we have evident proofs of the existence of a contractile and irritable power from some other principle; and a variety of facts concur in making it highly probable that it is by the exercise of such a principle that the different fluids are propelled through their respective vessels: nor is there any other method by which such propulsion can be reasonably accounted for. Grew ascribed the ascent of the sap to its levity, as though acting with the force of a vapour: Malpighi, to an alternate contraction and dilatation of the air contained in what he erroneously conceived to be air-vessels: Perrault, to fermentation: Hales and Tournefort, to capillary attraction: not one of which theories, however, will better explain the fact than another, as Dr. Thomson has ably established; as he has also the probability of a contractile power in the different sets of vessels distributed so wonderfully over the vegetable frame.†

That a contractile power may exist independently of muscular fibres, we have abundant proofs even in the animal system itself. We see it in the human cutis or skin, which, though totally destitute of such fibres, is almost for ever contracting or relaxing upon the application of a variety of other powers; powers external and internal, and totally different in their mode of operation. Thus, austere preparations and severe degrees of cold contract it very sensibly: heat, on the contrary, and oleaginous preparations, as sensibly relax it. The passions of the mind exercise a still more powerful effect over it: for while it becomes corrugated by fear and horror, it is smoothed and lubricated by pleasure, and violently agitated and convulsed by rage or anger.

Yet, could it even be proved that the vessels of plants are incapable of being made to contract by any power whatever, still should we have no great difficulty in conceiving a circulatory system in animals or vegetables without any such cause, while we reflect that one half of the circulation of the blood in man himself is accomplished without such a contrivance; and this, too, the more difficult half, since the veins, through the greater extent of their course, have to oppose the attraction of gravitation instead of being able to take advantage of it. It is in the present day, however, a well-known fact, and has been sufficiently ascertained by the late Dr. Parry of Bath, and on the Continent by Professor Dollinger, that the contractile power of the muscular fibres is not called into action even by the arteries in the course of the ordinary circulation of the blood, since, as we shall have occasion to observe, no increase of size or change of bulk of any kind takes place in arteries either in the contraction or dilatation of the heart's ventricles in a state of health, unless where they are pressed upon by the finger or some other cause of resistance.

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* Wildenow, Princip. of Botany, § 226.

† Syst. of Chem. vol. v. p. 388. 1807.

In what part of a plant the vital principle chiefly exists, or to what quarter it retires during the winter, we know not; but we are just as ignorant in respect to animal life. In both it operates towards every point; it consists in the whole, and resides in the whole; and its proof of existence is drawn from its exercising almost every one of its functions and effecting its combinations in direct opposition to the laws of chemical affinity, which would otherwise as much control it as they control the mineral world, and which constantly assume an authority as soon as ever the vegetable is dead. Hence the plant thrives and increases in its bulk; puts forth annually a new progeny of buds, and becomes clothed with a beautiful foliage of lungs (every leaf being a distinct lung in itself*) for the respiration of the rising brood; and with a harmonious circle of action, that can never be too much admired, furnishes a perpetual supply of nutriment in every diversified form, for the growth and perfection of animal life; while it receives in rich abundance, from the waste and diminution, and even decomposition of the same, the means of new births, new buds, and new harvests.

In fine, every thing is formed for every thing; and subsists by the kind intercourse of giving and receiving benefits. The electric fire that so alarms us by its thunder, and by the awful effects of its flash, purifies the stagnant atmosphere above us; and fuses, when it rushes beneath us, a thousand mineral veins into metals of incalculable utility. New islands are perpetually rising from the unfathomable gulfs of the ocean, and enlarging the boundaries of organized life; sometimes thrown up, all of a sudden, by the dread agency of volcanoes, and sometimes reared imperceptibly by the busy efforts of corals and madrapores. Liverworts and mosses first cover the bare and rugged surface, when not a vegetable of any other kind is capable of subsisting there. They flourish, bear fruit, and decay, and the mould they produce forms an appropriate bed for higher orders of plant-seeds, which are floating on the wings of the breeze, or swimming on the billows of the deep. Birds next alight on the new-formed rock, and sow, with interest, the seeds of the berries, or the eggs of the worms and insects on which they have fed, and which pass through them without injury; and an occasional swell of the sea floats into the rising island a mixt mass of sand, shells, drifted sea-weed, skins of the casuarina, and shells of the cocoa-nut. Thus the vegetable mould becomes enriched with animal materials; and the whole surface is progressively covered with herbage, shaded by forests of cocoa and other trees, and rendered a proper habitation for man and the domestic animals that attend upon him.

The tide that makes a desolating inroad on one side of a coast, throws up vast masses of sand on the opposite: the lygeum, or sea-matweed, that will grow on no other soil, thrives here and fixes it, and prevents it from being washed back or blown away; to which the lime-grass,* couch-grass,† sand-reed,‡ and various species of willow, lend their aid. Thus fresh lands are formed, fresh banks upraised, and the boisterous sea repelled by its own agency.

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* On the leafing of trees, there is a curious and valuable paper in the Swedish Amœnitates Academicæ, vol. iii. art. 46. by H. Barck, 1753, entitled Vernatio Arborum.

Frosts and suns, water and air, equally promote fructification in their respective ways; and the termes, or white ant, the mole, the hampster, and the earth-worm, break up the ground or delve into it, that it may enjoy their salubrious influences. In like manner, they are equally the ministers of putrefaction and decomposition; and liverworts and funguses, the ant and the beetle, the dew-worm, the ship-worm, and the woodpecker, contribute to the general effect, and soon reduce the trunks of the stoutest oaks, if lying waste and unemployed, to their elementary principles, so as to form a productive mould for successive progenies of animal or vegetable existence. Such is the simple but beautiful circle of nature. Every thing lives, flourishes, and decays: every thing dies, but nothing is lost; for the great principle of life only changes its form, and the destruction of one generation is the vivification of the next.§ Hence, the Hindu mythologists, with a force and elegance peculiarly striking, and which are no where to be paralleled in the theogonies of Greece and Rome, describe the Supreme Being, whom they denominate Brahm, as forming and regulating the universe through the agency of a triad of inferior gods, each of whom contributes equally to the general result, under the names of Brahma, Visnu, and Iswara; or the generating power, the preserving or consummating power, and the decomposing power. And hence the Christian philosopher, with a simplicity as much more sublime than the Hindu's, as it is more veracious, exclaims, on contemplating the regular confusion, the intricate harmony, of the scenes that rise before him—

> These, as they change, Almighty Father! these
> Are but the varied God. The rolling year
> Is full of Thee.

LECTURE IX.

ON THE GENERAL ANALOGY OF VEGETABLE AND ANIMAL LIFE.

(The subject continued.)

THE perfection of an art consists in the employment of a comprehensive system of laws, commensurate to every purpose within its scope, but concealed from the eye of the spectator; and in the production of effects that seem to flow forth spontaneously, as though uncontrolled by their influence, and which are equally excellent, whether regarded individually, or in reference to the proposed result.

Such is the great art of nature: and he who would study it with success must, as far as he is able, trace out its various laws, and reduce them to general principles, and collect its separate phænomena, and digest them into general classes. This, in many instances, we are able to do; and, in such cases we obtain a tolerable insight into the nature of things. But so vast, so unbounded is the theatre before us, so complicated is its machinery, and so closely does one fact follow up and press upon another, that we are often bewildered and lost in the mighty maze, and are incapable of determining the laws by which it is regulated, or of arranging the phænomena of which it is composed.

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* Elymus *arenarius*. † Triticum *repens*. ‡ Arundo *arenaria*.

§ See upon this subject the Swedish Amœnitates Academicæ, vol. v. art. 80. by J. H. Hagen. 1757, entitled Natura Pelagi.

The zoologist, in order to assist his inquiries, divides the whole animal creation into six general heads or classes; as those of mammals, birds, amphibials, fishes, insects, and worms. Each of these classes he subdivides into orders; of each of his orders he makes a distinct section for a multitude of kinds or genera; and each of his kinds becomes a still more subordinate section for the species or individuals of which the separate kinds consist. But he is perpetually finding, not only that many cases in each of his inferior divisions are so equally allied to other divisions that he knows not how to arrange them, but that even his classes or first divisions themselves labour under the same difficulty; since he occasionally meets with animals that by the peculiarity of their construction seem equally to defy all artificial method and all natural order. Thus the myxine *glutinosa*, which by Linnéus was regarded and ranked as a worm, has been introduced by Bloch into the class of fishes, and is now known by the name of gastrobranchus *cæcus*, or hag-fish. The siren *lacertina*, which was at first contemplated by Linnéus as an amphibious animal of a peculiar genus, was afterwards declared by Camper and Gmelin to be a fish, approaching the nature of an eel, and was arranged accordingly. It has since, however, been restored from the class of fishes to that of amphibials, and is in the present day believed by various zoologists to be nothing more than a variety of the lizard. And thus the hippopotamus, the tapir, and the swine, which by Linnéus were ranked in the fifth order of mammals with the horse, are arranged by Cuvier with the rhinoceros and the sokotyro, that have hitherto formed a part of the second order.

The eel, in its general habits and appearance, has a near similitude to the serpent; many of its species live out of the water as well as in it; and, like the serpent, hunt for worms, snails, and other food, over meadows and marshes.

The platypus *anatinus*, or duck bill, (the ornithorhyncus *paradoxus* of Blumenbach,) one of the many wonders of New South Wales, unites in its form and habits the three classes of birds, quadrupeds, and amphibials. Its feet, which are four, are those of a quadruped; but each of them is palmate or webbed, like a wild fowl's; and instead of lips it has the precise bill of a shoveler or other broad-billed water bird; while its body is covered with a fur exactly resembling an otter's. Yet it lives, like a lizard, chiefly in the water, digs and burrows under the banks of rivers, and feeds on aquatic plants and aquatic animals. The viverra or weasel, in several of its species, approaches the monkey and squirrel tribes; is playful, a good mimic, and possesses a prehensile tail. The flying squirrel, the flying lizard, or draco *volans*, and especially the bat, approach in their volant endowment the buoyancy of birds, and are able to fly by winged membranes instead of by feathers. The exocetus *volitans*, or flying-fish, and several other fishes, derive a similar power from their long pectoral fins; while the troctilus, or humming-bird, unites the class of birds with that of insects. It is in one of its species, t. *minimus*, the least of the feathered tribes; feeds, like insects, on the nectar of flowers alone, and like the bee, or butterfly, collects it while on the wing, fluttering from flower to flower, and all the while humming its simple accent of pleasure. Its tongue, like that of many insects, is missile. When taken it expires instantly; and after death, on account of its diminutive size, the elegance of its shape, and the beauty of its plumage, it is worn by the Indian ladies as an ear-ring.

Such being the perplexity and seeming confusion that extend through the whole chain of animal life, it is not to be wondered at that we should at times meet with a similar embarrassment in distinguishing between animal life and plants, and between plants and minerals. I gave a cursory glance at this subject in our last lecture, and especially in regard to that extraordinary division of organized substances which, for want of a better term, we continue to denominate zoophytes; many of which, as, for example, various species of the alcyony and madrepore, bear a striking resemblance to crystals, and other mineral concretions; while great numbers of them, and particularly the corals, corallines, and some other species of alcyony, as the sea-fig, sea-quince, pudding-weed, and above all the stone-lily, (which last, however, is now only found in a petrified state,) have the nearest possible approach to a vegetable appearance. Whence, as I have already observed, among the earlier naturalists, who expressly directed their attention to these substances, some regarded them as minerals, and others as vegetables; and it is not till of late years, only, indeed, since it has been ascertained that the chemical elements they give forth on decomposition are of an animal nature, that they have been admitted into the animal kingdom.

Among plants, in like manner, we often meet with instances of individual species that are equally doubtful, not only as to what kind, order, or class of vegetable existence they belong, but even as to their being of a vegetable nature of any kind, till their growth, their habits, and their composition are minutely examined into. But independently of these individual cases, we also perceive, in the general principle of action in animal life, that the more it is investigated, the more it is calculated to excite our astonishment, and to indicate to us, so far as relates to the SUBORDINATE POWERS of the animal frame, the application of one common system to both, and to demonstrate one common derivation, from one common and Almighty Cause. Having, therefore, in our last lecture, submitted to your attention a brief outline of the structure of plants, I shall now proceed to point out a few of these general resemblances, and shall endeavour to select those which are either most curious or most prominent.*

Plants, then, like animals, are produced by ordinary generation; and though we meet with various instances of production by the generation of buds and bulbs, or of slips and offsets, the parallelism, instead of being hereby diminished, is only drawn the closer: for we meet with just as many instances of the same varieties of propagation among animals. Thus the hydra, or polype, as it is more generally called, the asterias, and several species of the leech, as the hirudo *viridis*, for example, are uniformly propagated by lateral sections, or pullulating slips or offsets;† while almost every genus of zoophytic worms is only capable of increase by buds, bulbs, or layers; and some of these animals, like the house-leek and various grasses, by spontaneous separation. In effect, most of the kinds now referred to, whether animals or vegetables, may be regarded less as single individuals than as assemblages or congeries of individuals; for in most of them every part exists distinctly of every other part, and is often a miniature of the general form. The various branches of a tree offer a similar example, and present a striking contrast with the various branches of a perfect animal. In the latter every distinct part contributes to one perfect whole: the arm of a man has no heart, no lungs, no stomach; but the branch of a tree has a complete system of organs to itself, and is hence capable in many cases of existing by itself, and producing buds, layers, and other kinds of offspring, when separated from the trunk. The different parts of the polype are equally independent, and are hence equally capable of a separate increase. It is owing to this principle we are able to graft and bud: and M. Trembley having applied the same kind of operation to the animals we are now speaking of, found that, by numerous grafts of different kinds upon each other, he was enabled to produce monsters as wild and extravagant as the most visionary poet or fabulist ever dreamed of.

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* Consult also Mr. Knight's article, Phil. Trans. 1810, part ii. p. 179—181.

† Thus Aristotle, upon a subject which is generally supposed to be of modern discovery, Ὡσπερ γαρ τα φυτα και ταυτα (scilicet) εντομα̃ διαιρουμενα δυναται ζην. "For, like plants, such insects also maintain life, after slips or cuttings." *Hist. Anim.* lib. iv. ch. 8.

See a variety of other curious instances in the author's translation of Lucretius, note to b. ii. ver. 880.

The blood of plants, like that of animals, instead of being simple is compound, and consists of a great multitude of compacter corpuscles, globules for the most part, but not always globules, floating in a looser and almost diaphanous fluid. From this common current of vitality, plants, like animals, secrete a variety of substances of different, and frequently of opposite powers and qualities,—substances nutritive, medicinal, or destructive. And, as in animal life, so also in vegetable, it is often observed that the very same tribe, or even individual, that in some of its organs secretes a wholesome aliment, in other organs secretes a deadly poison. As the viper pours into the reservoir situated at the bottom of his hollow tusk a fluid fatal to other animals, while in the general substance of his body he offers us not only a healthful nutriment, but, in some sort, an antidote for the venom of his jaw: so the jatropha *Manihot*, or Indian cassava, secretes a juice or oil extremely poisonous in its root, while its leaves are regarded as a common esculent in the country, and are eaten like spinach-leaves among ourselves; though the root, when deprived, by exposure to heat, of this poisonous and volatile oil, is one of the most valuable foods in the world, and gives bread to the natives, and tapioca as an article of commerce. Its starch is like that of the finest wheat-flour, and combined with potatoes and sugar, yields a very excellent cider and perry, according to the proportions employed. In like manner, while the bark of the cinnamon tree (laurus *Cinnamomum*) is exquisitely fragrant, the smell of the flowers is highly offensive, and by most persons is compared to that of newly-sawn bones,—by St. Pierre to that of human excrement.* So the cascarilla bark and castor oil are obtained from plants poisonous in some part or other.

The amyris, in one of its species offers the balm-of-Gilead tree; in another, the gum-elemi tree; and in a third,† the poison-ash, that secretes a liquid gum as black as ink. It is from a fourth species of this genus, I will just observe as I pass along, in order the more completely to familiarize it to us, that we obtain that beautiful plant which, under the name of rose-wood,[*] is now so great a favourite in our drawing-rooms.

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* Mr. Marshall's account delivered to the Royal Society. See Thomson's Annals, Sept. p. 242.

† A. *toxifera.*

The acacia *nilotica*,[†] or gum-Arabic tree, is a rich instance in proof of the same observation. Its root throws forth a fluid that smells as offensively as assafœtida; the juice of its stem is severely sour and astringent; the secernents of its cutis exude a sweet, saccharine, nutritive gum, the common gum-Arabic of the shops, and its flowers diffuse a highly fragrant and regaling odour. So the Arenga palm produces sugar, an excellent sago, and a poisonous juice that even irritates the skin.

But perhaps the laurus, as a genus, offers us the most extensive variety of substances of different qualities. This elegant plant, in one of its species, gives us the cinnamon tree;[‡] in another, the cassia, or wild cinnamon;[§] in a third, the camphor tree;[‖] in a fourth, the alligator pear;[¶] in a fifth, the sassafras;[**] in a sixth, a sort of gum-Benjamin,[††] though not the real gum-Benjamin, which is a styrax; while in a seventh, the l. *caustica*, it exhibits a tree with a sap as poisonous as that of the manchineel.

And truly extraordinary is it, and highly worthy of notice, that various plants, or juices of plants, which are fatally poisonous to some animals, may not only be eaten with impunity by others, but will afford them a sound and wholesome nutriment. How numerous are the insect tribes that feed and fatten on all the species of euphorbia, or noxious spurge! The dhanesa, or Indian buceros, feeds to excess on the nux vomica; the land-crab[‡‡] on the berries of the hippomane or manchineel-tree, and the loxia (grossbeak) of the Bahamas on the fruit of the amyris *toxifera*, or poison-ash.[§§] The leaves of the kalmia *latifolia* are feasted on by the deer and the round-horned elk, but are mortally poisonous to sheep, to horned cattle, to horses, and to man. The bee extracts honey without injury from its nectary, but the adventurer who partakes of that honey, after it is deposited in the hive-cells falls a victim to his repast.

There are some tribes of animals that exfoliate their cuticle annually, such as grasshoppers, spiders, several species of crabs, and serpents. Among vegetables we meet with a similar variation from the common rule, in the shrubby cinquefoil,[‖‖] indigenous to Yorkshire, and the plane-tree of the West-Indies,[¶¶] which most readers know sends forth every spring new colonies by means of runners, as we usually denominate them, in every direction, that shortly after they have obtained a settlement for themselves, break off all connexion with the parent stock.

Among animals, some are locomotive or migratory, and others stationary or permanent; the same variety is to be traced among vegetables. Unquestionably the greater number of animals are of the migratory kind, yet in every order of worms we meet with some instances that naturally appertain to the latter, while almost every genus and species of the zoophytic order, its millepores, madrepores, tubipores, gorgonias, isises, corallines, and sponges, can only be included under it. Plants, on the contrary, are for the most part stationary, yet there are many that are fairly entitled to be regarded as locomotive or migratory. The natural order SENTICOSÆ, the ICOSANDRIA POLYGYNIA of the sexual system, offers us a variety of instances, of which the *fragaria* or strawberry genus may be selected as a familiar example. The palmate, the testicular, and the premorse rooted tribes afford us similar proofs: many of these grow from a new bulb, or knob, or radicle, while the old root, of whatever description it may be, dies away; in consequence of which we can only conclude that the vital principle of the plant has quitted an old, dilapidated, and ruinous mansion, to take possession of a new one. Insomuch that were a person, on the point of travelling to the East Indies, to plant the root of an orchis,* or a scabious,† in a particular spot in his garden, and to search for it in the same spot on his return home, he would be in no small degree disappointed; and if he were to remain abroad long, he must carry his pursuit to half an acre's distance, for thus far would some of these roots perhaps have travelled in a few years.

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[*] A. *balsamifera.*

[†] Mimosa *nilotica*, Linn.

[‡] L. *Cinnamomum.*

[§] L. *Cassia.*

[‖] L. *Camphora.*

[¶] L. *Persea.*

[**] L. *Sassafras.*

[††] L. *Benzoin.*

[‡‡] Cancer *Ruricola.*

[§§] See on this subject the following curious papers in the Swedish Amœnitates Academicæ, vol. ii. art. 25 par Sueisens, by N. L. Hesselgren. The same subject continued by G. P. Tengmalon, Amœn. Acad. vol. x. art. x. Usus Historiæ Naturalis, by M. Aphonin, art. 147. Id. in respect to birds, entitled Esca Avium domesticarum, by P. Holmbergen, p. 481. art. 163.

It is also well worthy of remark, that various herbaceous plants which spring up among others that are esculent, yet are rejected by cattle when offered alone, give a higher relish and even salubrity to the fodder with which they are intermixed. This, as Sir J. E. Smith has admirably observed, is particularly the case with the grasses. "As man cannot live on tasteless unmixed flour alone, so neither can cattle in general be supported by mere grass, without the addition of various plants, in themselves too acid, bitter, salt, or narcotic, to be eaten unmixed. Spices, and a portion of animal food supply us with the requisite stimulus or additional nutriment, as the ranunculus tribes, and many others, season the pasturage and fodder of cattle."—*Engl. Flora*, vol. i.

[‖‖] Potentilla *fruticosa.*

[¶¶] Platanus *occidentalis.*

The male valisneria sails from shore to shore over the water in pursuit of his female. And a multitude of sea-plants float through the ocean, and having plenty of food wherever they go, send out no roots in order to search for it.

Plants, like animals, have a wonderful power of maintaining their proper temperature, whatever be the temperature of the atmosphere that surrounds them; and hence occasionally of raising the thermometer, and occasionally of depressing it. Like animals, too, they are found to exist in most astonishing degrees of heat and cold, and to accommodate themselves accordingly. Wherever the interest or curiosity of man has led him into climates of the highest northern latitudes; wherever he has been able to exist himself, or to trace a vestige of animal being around him; there, too, has he beheld plants of an exquisite beauty and perfection; perfuming, in many instances, the dead and silent atmosphere with their fragrances, and embellishing the barren scenery with their corols.

It is said that animals of a certain character, the cold-blooded and amphibious, have a stronger tenacity to life than vegetables of any kind. But the assertion seems to have been hazarded too precipitately; for, admitting that the common water-newt‡ has been occasionally found imbedded in large masses of ice, perfectly torpid and apparently frozen; and that the common eel,§ when equally frozen and torpified, is capable of being conveyed a thousand miles up the country, as from St. Petersburg, for example, to Moscow, in which country, we are told, it is a common practice thus to convey it; and that both, on being carefully thawed, may be restored to as full a possession of health and activity as ever; yet the torpitude hereby induced can only be compared to that of deciduous plants in the winter months; during which season we all know that, if proper care be exercised, they may be removed to any distance whatever without the smallest inconvenience.

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* Orchis *morio,* or *latifolia.*

† Scabiosa *succisa,* or devil's bit.

‡ Lacerta *aquatica.*

§ Muræna *Anguilla.*

Plants, again, are capable of existing in very high degrees of heat. M. Sonnerat found the vitex *Agnus castus*, and two species of aspalathus, on the banks of a thermal rivulet in the island of Lucon, the heat of which raised the themometer to 174° of Fahrenheit, and so near the water that its roots swept into it. Around the borders of a volcano in the isle of Tanna, where the thermometer stood at 210°, Mr. Forster found a variety of flowers flourishing in the highest state of perfection; and confervas, and other water-plants, are by no means unfrequently traced in the boiling springs of Italy, raising the thermometer to 212° or the boiling point.

Animals are capable of enduring a heat quite as extreme. Air has often been breathed by the human species with impunity at 264°. Tillet mentions its having been respired at 300°; the Royal Academy asserts at 307°, or 130° Reaumur, in an oven, for the space of ten minutes;* and Morantin gives a case at 325° Fahr., and that for a space of five minutes. Even in the denser medium of water, animals of various kinds, and especially fishes, have been occasionally traced alive and in health in very high temperatures. Thus Dr. Clarke asserts, that in one of the tepid springs of Bonarbashy, situated near the Scamander, or Mender as it is now called, notwithstanding the thermometer was raised to 62° Fahr., fishes were seen sporting in the reservoir.†

So in the thermal springs of Bahia in Brazil many small fishes are seen swimming in a rivulet that raises the thermometer to 88°, the temperature of the air being only 77½°. Sonnerat, however, found fishes existing in a hot spring at the Manillas at 158° Fahr.;‡ and M. Humboldt and M. Bonpland, in travelling through the province of Quito in South America, perceived other fishes thrown up alive, and apparently in health, from the bottom of a volcano, in the course of its explosions, along with water and heated vapour that raised the thermometer to 210°, being only two degrees short of the boiling point.§

In reality, without wandering from our own country, we may at times meet with a variety of other phænomena perfectly consonant in their nature, and altogether as extraordinary, if we only attend to them as they rise before us. Thus the eggs of the musca *vomitoria*, our common flesh-fly, or blow-fly, are often deposited in the heat of summer upon putrescent meat, and broiled with such meat over a gridiron in the form of steaks, in a heat not merely of 212°, but of three or four times 212°; and yet, instead of being hereby destroyed, we sometimes find them quickened by this very exposure into their larve or grub state. And although I am ready to allow that, in the simple form of seeds or eggs, plants or animals may be expected to sustain a far higher degree of heat or cold with impunity, than in their subsequent and more perfect state; yet it cannot appear more extraordinary that in such perfect state they should be able to resist a heat of 210° or 212°, than that in the state of seeds or eggs they should be able to exist in, and to derive benefit from, a heat three or four times as excessive.

In the vegetable world we meet with other peculiarities quite as singular, and which gives them an approach to the mineral kingdom: we have already observed that some of them, and especially among the algæ and the mosses, are nearly altogether incombustible, as the byssus *asbestos*, which, on being thrown into the fire, instead of burning, is converted into glass; and the fontinalis *antipyretica*, a plant indigenous to the Highlands, but more frequent in Scandinavia, where from its difficulty of combustion it is used by the poor as a lining for their chimneys to prevent them from catching fire.

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* Hist. de l'Acad. Royale des Sciences, 1764, p. 186. h. 16.

† Travels, part II. Greece, Egypt, and the Holy Land, p. 111. 4to. ed.

‡ He graduates by Reaumur's thermometer, and calculates the heat upon this at 690.

§ Recueil d'Observations de Zoologie et d'Anatomie comparee.

Animals are often contemplated under the three divisions of terrestrial, aquatic, and aërial. Plants may be contemplated in the same manner. Among animals it is probable that the largest number consists of the first division; yet from the great variety of submarine genera that are known, and from nearly an equal variety, perhaps, that are not known, this is uncertain. Among vegetables, however, it is highly probable that the largest number belongs to the submarine section, if we may judge from the almost countless species of fuci and other equally prolific tribes of an aqueous and sub-aqueous origin, and the incalculable individuals that appertain to each species; and more especially if we take into consideration the greater equality of temperature which must necessarily exist in the submarine hills and valleys.

Many animals are amphibious, or capable of preserving life in either element; the vegetable world is not without instances of a similar power. The algæ, and especially in the ulva and fucus tribes, offer us a multitude of examples. The juncus, or rush, in many of its species, is an amphibious plant; so, too, is the oryza or rice-plant. In other words, all these will flourish entirely covered with water, or with their roots alone shooting into a moist soil.

Animals of various kinds are aërial; perhaps the term is not used with strict correctness. It will, at least, apply with more correctness to plants. All the most succulent plants of hot climates are of this description: such are several of the palms and of the canes; and the greater number of plants that embellish the arid Karro fields of the Cape of Good Hope.* Succulent as they are, these will only grow in soils or sands so sere and adust that no moisture can be extracted from them, and are even destroyed by a full supply of wet or by a rainy season. The Solandra *grandiflora*, a Jamaica shrub, was long propagated in our own stoves by cuttings, which, though freely watered, could never be made to produce any signs of fructification, notwithstanding that the cuttings grew several feet in length every season. By accident a pot with young cuttings was mislaid and forgotten in the Kew garden, and had no water given it; it was hereby reduced to its healthy aridity, and every extremity produced a flower.†

And hence it is an opinion common to many of the ablest physiologists of the present day, that these derive the whole of their nutriment from the surrounding atmosphere; and that the only advantage which they acquire from thrusting their roots into such strata is that of obtaining an erect position. There are some quadrupeds that appear to derive nutriment in the same manner. Thus the bradypus *tridactylus*, or sloth, never drinks, imbibes by its cutaneous absorbents, and trembles at the feeling of rain; and, in common with the bird tribes, has only one ultimate or excrementary duct; while the olive cavy‡ avoids water of every kind almost as pertinaciously, as does also the ostrich, which is in consequence said by the Arabs never to drink. And yet these are animals almost as succulent as any we are acquainted with.

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* The only rain that waters this tract is that which falls for a few weeks in the winter; during the hot and fertile months there is no rain whatever.

† Smith's Introduction to Botany, &c. p. 141.

‡ Cavia *Acuschy*. This is the more extraordinary, because the c. *Cobaya*, or Guinea-pig, drinks freely; and the c. *Capybara*, or river cavy, is fond of swimming and diving.

But however true this may be with regard to animals, we have manifest proofs that vegetables of certain tribes and descriptions are altogether supported by the atmosphere that surrounds them; for, important as is the organ of a root to plants in general, there are several which have no root whatever, and can derive nutriment in no other way. The water-caltrop* is an instance directly in point. The seed of this plant has no rostel, and consequently can never, in the first instance, become rooted. From the horned nut or pericarp of the seed, as it lies in water, which is its natural element, shoots forth a long plumule perpendicularly towards the surface of the stream; during the ascent of which a variety of capillary branched leaves shoot forth from the sides of the plumule, some of which bend downward, and fix the whole plant to the bottom by penetrating into the soil below the stream; the leaves alone in this late stage of germination acting the part of a root, and giving maturity to the still unfinished plant. The cactus genus, in some of its very numerous species, offers us an example of similar evolution; and especially in the opuntia tribe, or that which embraces the prickly pears or Indian figs of our green-houses, of which the cochineal plant† is one form. Of these, several grow by the mere introduction of one of their thick fleshy leaves into a soil of almost any kind that is sufficiently dry; they obtain an erect position, but never root, or shoot forth radicles: and hence almost the whole of their moisture must necessarily be derived from the surrounding atmosphere.

Perhaps one half of the fuci have no root whatever: many of them, indeed, consist of vesicles or vesicular bulbs alone, sessile upon the matrix of some stone or shell that supports them, and propagate their kinds by offsets, without any other vegetable organs. The seeds of the fucus *prolifer* sometimes evolve nothing but a leaf; the plant being propagated also by leaf upon leaf, either forked or elliptic, without root.

The aphyteia *hydnora* is a curious instance in point. This plant is equally destitute of leaves, stem, and root; and consists alone of a sessile, coriaceous, and succulent flower, eaten as a luxury by the Hottentots, and parasitic to the roots of the euphorbia *Mauritanica;* flower propagating flower from generation to generation.

But perhaps the plant most decisive upon this subject is the aërial *epidendrum*,‡ first, if I mistake not, described by that excellent Portuguese phytologist Loureiro, and denominated *aërial* from its very extraordinary properties. This is a native of Java and the East Indies beyond the Ganges; and, in the latter region, it is no uncommon thing for the inhabitants to pluck it up, on account of the elegance of its leaves, the beauty of its flower, and the exquisite odour it diffuses, and to suspend it by a silken cord from the ceilings of their rooms; where, from year to year, it continues to put forth new leaves, new blossoms, and new fragrance, excited alone to new life and action by the stimulus of the surrounding atmosphere.

That stimulus is oxygene; ammonia is a good stimulus, but oxygene possesses far superior powers, and hence without some portion of oxygene few plants can never be made to germinate. Hence, too, the use of cowdung and other animal recrements, which consist of muriatic acid and ammonia: while in fat, oil, and other fluids, that contain little or no oxygene, and consist altogether, or nearly so, of hydrogene and carbone, seeds may be confined for ages without exhibiting any germination whatever. And hence, again, and the fact deserves to be extensively known, however torpid a seed may be, and destitute of all power to vegetate in any other substance if steeped in a diluted solution of oxygenated muriatic acid, at a temperature of about 46° or 48° of Fahrenheit, provided it still possess its principle of vitality it will germinate in a few hours. And if, after this, it be planted, as it ought to be, in its appropriate soil, it will grow with as much speed and vigour as if it had evinced no torpitude whatever.

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* Trapa *natans*. † Cactus *coccinellifer*. ‡ Epidendrum *flos aeris*.

I have said that few plants can be made to germinate when the oxygene is small in quantity, and the hydrogene abundant: and I have made the limitation, because aquatic plants, and such as grow in marshes, and other moist places, are remarkable, not only for parting with a large quantity of oxygene gas, but also for absorbing hydrogene gas freely; and are hence peculiarly calculated for purifying the regions in which they flourish, and in some sort for correcting the mischief that flows from the decomposition of the dead vegetable and animal materials that is perpetually taking place in such situations, and loading the atmosphere with febrile and other miasms.

But the instances of resemblance between animal and vegetable physiology are innumerable. Some plants, like a few of our birds, more of our insects, and almost all our forest beasts, appear to sleep through the day, and to awake and become active at night; while the greater number, like the greater number of animals, resign themselves to sleep at sunset, and awake re-invigorated with the dawn. Like animals, they all feel the living power excited by small degrees of electricity, but destroyed by severe shocks; and like animals, too, they differ in a very extraordinary degree in the duration of many of their species. Some tribes of boletus unfold themselves in a few hours, like the ephemera and hemerobius tribes (May-fly and Spring-fly), and as speedily decay. Several of the fungi live only a few days; others weeks or months. Annual plants, like the greater part of our insects, live three, four, or even eight months. Biennial plants, like the longer-lived insects, and most of our shell-fishes, continue alive sixteen, eighteen, or even twenty-four months. Many of the herbaceous plants continue only a few years, but more for a longer period, and imitate all the variety to be met with in the greater number of birds, quadrupeds, and fishes; while shrubs and trees are, for the most part, coequal with the age of man, and a few of them equal that allotted to him in the earliest periods of the world. Of these last, the Adansonia *digitata*, or calabash tree, is perhaps one of the most extraordinary. Indigenous to the land of the patriarchs, and still outrivalling the patriarchal age, this stupendous tree, compared with which our own giant oak, in bulk as well as in years, is but an infant, seems to require not less than a thousand years to give it full vigour and maturity. Extending its enormous arms over the dry and barren soil from which it shoots naturally, it affords shelter to whole nations of barbarians, and on its pleasant subacid fruit administers an ample supply to their hunger.

Let it not, however, be imagined that, by pointing out such frequent instances of resemblance between animal and vegetable life, I mean to degrade the rank of animal being from its proper level; for it will be one of the chief objects of our subsequent studies to develope and delineate its multiform and characteristic superiorities. I am only tracing at present the common principle of vitality to its first outlines; I am endeavouring to unfold to you, in its simplest and rudest operations, that grand, and wonderful, and comprehensive system, which, though under different modifications, unquestionably controlling both plants and animals, from the first moment it begins to act infuses energy into the lifeless clod, draws forth form and beauty, and individual being, from unshapen matter, and stamps with organization and propensities the common dust we tread upon. And if, in this its lowest scale of operation,—if, under the influence of these its simplest laws, and the mere powers (so far as we are able to trace them) of contractility and irritability, it be capable of producing effects thus striking, thus incomprehensible, what may we not expect when the outline is filled up and the system rendered complete? What may we not expect when we behold, superadded to the powers of contractility and irritability, those of sensation and voluntary motion? What, more especially, when to these are still further added the ennobling faculties of a rational and intelligent soul,—the nice organs of articulation and speech, the eloquence of language,—the means of interchanging ideas, and of embodying, if I may so express myself, all the phænomena of the mind?

Such are the important subjects to which our subsequent studies are to be directed. In the meantime, from the remarks which have already been hazarded, we cannot, I think, but be struck with the two following sublime characters, which pre-eminently, indeed, distinguish all the works of nature:—a grand comprehensiveness of scheme, a simple but beautiful circle of action, by which every system is made to contribute to the well-being of every system, every part to the harmony and happiness of the whole; and a nice, and delicate, and ever-rising gradation from shapeless matter to form, from form to feeling, from feeling to intellect, from the clod to the crystal, from the crystal to the plant, from the plant to the animal, from brutal life to man. Here, placed on the summit of this stupendous pyramid, lord of all around him, the only being through the whole range of the visible creation endowed with a power of contemplating and appreciating the magnificent scenery by which he is encompassed, and of adoring its Almighty Architect—at once the head, the heart, and the tongue of the whole—well, indeed, may he exult and rejoice! But let him rejoice with modesty. For, in the midst of this proud exaltation, it is possible that he forms but one of the lowest links in "the golden everlasting chain" of intelligence; that he stands on the mere threshold of the world of perception; and that there exists at least as wide a disproportion between the sublimest characters that ever were born of women, our Bacons, Newtons, and Lockes, our Aristotles, Des Cartes, and Eulers, and the humblest ranks of a loftier world, as there is between these highly-gifted mortals and the most unknowing of the animal creation. Yet MIND, thanks to its beneficent bestower! is itself immortal, and knowledge is eternally progressive; and hence man, too, if he improve the talents intrusted to him, as it is his duty to do, may yet hope, unblamed, to ascend hereafter as high above the present sphere of these celestial intelligences, as they are at present placed above the sphere of man. But these are speculations in some degree too sublime for us; the moment we launch into them, that moment we become lost, and find it necessary to return with suitable modesty to our proper province, an examination of the world around us; where, with all the aids of which we can avail ourselves, we shall still find difficulties enough to try the wisdom of the wisest, and the patience of the most persevering.

LECTURE X.

ON THE PRINCIPLE OF LIFE, IRRITABILITY, AND MUSCULAR POWER.

We have distinguished organic from inorganic matter; and have characterized the former, among other differences, by its being actuated in every separate form by an internal principle, and possessed of parts mutually dependent and contributory to each other's functions. What then is this internal principle,—this wonderful and ever active power, which, in some sort or other, equally pervades animals and vegetables,—which extends from man to brutes, from brutes to zoophytes, from zoophytes to fucuses and confervas, the lowest tribes of the vegetable kingdom, whose general laws and phænomena constituted the subject of our last study,—this fleeting and evanescent energy, which, unseen by the eye, untracked by the understanding, is only known, like its great Author, by its effects; but which, like him too, wherever it winds its career, is perpetually diffusing around it life and health, and harmony and happiness?

I do not here enter into the consideration of a thinking or intelligent principle, or even a principle of sensation, both which are altogether of distinct natures from the present, and to which I shall entreat your attention hereafter; but confine myself entirely to that inferior but energetic power upon which the identity and individuality of the being depends, and upon a failure of which the individual frame ceases, the organs lose their relative connexion, the laws of chemistry, which have hitherto been controlled by its superior authority, assume their action, and the whole system becomes decomposed and resolved into its primary elements.

The subject is, indeed, recondite, but it is deeply interesting: it has occupied the attention of the wisest and the best of mankind in all ages; and though, after the fruitless efforts with which such characters have hitherto pursued it, I have not the vanity to conceive that I shall be able to throw upon it any thing like perfect day-light, you will not, I presume, be displeased with my submitting to you a brief outline of some few of the speculations to which it has given birth, together with the conjectures it has excited in my own mind.

Of the innumerable theories that have been started upon this subject, the three following are those which are chiefly entitled to our attention. Life is the result of a general harmony or consent of action between the different organs of which the vital frame consists.—Life is a principle inherent in the blood.—Life is a gas, or aura, communicated to the system from without. Each of these theories has to boast of a very high degree of antiquity; and each, after having had its day, and spent itself, has successively yielded to its rivals; and in its turn has re-appeared, under a different modification, in some subsequent age, and run through a new stage of popularity.

For THE SYSTEM OF HARMONY we are indebted to the inventive genius of Aristoxenus, a celebrated physician of Greece, who was at first a pupil of Lamptus of Erythræa, afterwards of Xenophylus the Pythagorean, and lastly of Aristotle. He was most excellently skilled in music, and is supposed to have given the name of HARMONY to his system from his attachment to this science. It is an ingenious and elegant dogma, and was at one time highly fashionable at Rome as well as at Athens; and is thus alluded to and explained by Lactantius: "As in musical instruments, an accord and assent of sounds, which musicians term HARMONY, is produced by the due tone of the strings; so in bodies, the faculty of perception proceeds from a connexion and vigour of the members and organs of the frame."*

To this theory there are two objections, either of which is fatal to it. The first is, that admitting the absolute necessity of the health or perfection of every separate part to the health or perfection of the whole, we are still as much in the dark as ever in respect to the principle by which this harmonious machine has been developed, and is kept in perpetual play. The second objection, by which, indeed, it was vigorously attacked by the Epicureans, and at length completely driven from the field, is derived from observing that the health or well-being of the general system does not depend upon that of its collective organs; and that some parts are of far more consequence to it than others. Thus the mind, observes Lucretius, in his able refutation of this hypothesis, may be diseased, while the body remains unaffected; or the body on the contrary, may lose some of its own organs, while the mind, or even the general health of the body itself, continues perfect.

The abbé Polignac, who, consistently with the Cartesian system, makes a very proper distinction between the principle of the mind or soul, and that of the life, enters readily into the hypothesis of Aristoxenus in regard to the latter power, though he thinks it inapplicable to the former: and Leibnitz appears to have availed himself of it as a means of accounting for the union between the soul and body in his celebrated system, which he seems to have named, from the theory before us, the system of PRE-ESTABLISHED HARMONY. By a writer of the present day, however, M. Lusac, the doctrine of Aristoxenus seems to have been resuscitated in its fullest scope, and even to have been carried to a much wider latitude than its inventor had ever intended: for the theory of M. Lusac affects to regard, not only the frame of man and other animals, but the vast frame of the universe, as a sort of musical organ or instrument; the concordant and accumulated action of whose different parts or agents he denominates, like Aristoxenus, *harmony*. "Concerts of music," says he, "afford a clear example: you perceive harmony in music when different tones, obtained by the touch of various instruments, excite one general sound, a compound of the whole." This observation he applies to the grand operations of nature, the irregularities of which, resulting from inundations, earthquakes, volcanoes, tempests, and similar evils, this philosopher considers as the dissonances occasionally introduced into music to heighten the harmony of the entire system. With respect to the harmony of the human frame, individually contemplated, or the concordant action of the different parts of the body, he observes, "It may be said, that of this principle I have merely a confused notion; and I admit it, if the assertion imply that I have neither a perfect, nor a distinct, nor an entire comprehension of what produces this harmony—in what it consists, or how it acts. I know not what produces the harmony of various instruments heard simultaneously; but I can accurately distinguish the sounds which are occasioned when musicians are *tuning*, from those which are produced when, being completely in tune, and every one uniting in the piece, the separate parts are executed with procision. When I hear an harmonious sound, whatever be its nature, I can distinguish the harmony, though incapable of investigating its cause."*

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* v. 140.

I shall only observe, further, that in the doctrine of Mr. (now Sir Humphry) Davy, which holds life itself as a perpetual series of corpuscular changes, and the substrate, or living body, as the being in which these changes take place, we cannot but observe a leaning towards the same system; and we shall have occasion, in a subsequent lecture, to notice one or two others of equally modern date that touch closely upon it in a few points.†

Let us pass on, then, to a consideration of the second hypothesis I have noticed, and which consists in regarding the BLOOD ITSELF AS THE PRINCIPLE OF LIFE. This opinion lays claim to a still higher antiquity than the preceding; and, in a general view of the question, is far better founded. It has the fullest support of the Mosaic writings, which expressly appeal to the doctrine, that "the life of all flesh is the blood thereof,"‡ as a basis for the culinary section of the Levitical code; a doctrine, indeed, of no new invention even at that early period, but probably derived expressly from the ritual of the higher patriarchs, if we may be allowed to appeal to a similar belief and a similar practice among the Parsees, Hindus, and other oriental nations of very remote antiquity, who seem rather to have drawn this part of their ceremonial directly from the law or tradition of the patriarchs, than indirectly from that of the Jews.

Among the Greeks and Romans, were the authority of the poets to be of any avail, we should imagine that this hypothesis never ceased to be in reputation; for the πορφυρεος θανατος, or *purple death*, of Homer, and the *purpurea anima*, or *purple life*, of Virgil, (phrases evidently derived from this theory,) are common-place terms amidst all of them: but the real fact is, that, among the philosophers, we do not know of more than two, Empedocles and Critias, who may be fairly said to have embraced it.

In modern times, however, this hypothesis has again dawned forth, and risen even to meridian splendour, under auspices that entitle it to our most attentive consideration. Harvey, to whom we are indebted for a full knowledge of the circulation of the blood, may be regarded as the phosphor of its uprising; Hoffman speedily became a convert to the revived doctrine; Huxham not only adopted it, but pursued it with so much ardour, as, in his own belief, to trace the immediate part of the blood in which the principle of life is distinctly seated, and which he supposed to be its red particles. But it is to that accurate and truly original physiologist, Mr. John Hunter, that we can only look for a fair restoration of this system to the favour of the present day, or for its erection upon any thing like a rational basis. By a variety of important experiments, this indefatigable and accurate observer succeeded in proving incontrovertibly that the blood contributes in a far greater degree, not only to the vital action, but to the vital material of the system, than any other constituent part of it, whether fluid or solid. But he went beyond this discovery, and afforded equal proof, not only that the blood is a mean of life to every other part, but that it is actually alive itself. "The difficulty," says he, "of conceiving that the blood is endowed with life, while circulating, arises merely from its being a fluid, and the mind not being accustomed to the idea of a living fluid.—I shall endeavour," he continues, "to show that organization and life do not in the least depend upon each other; that organization may arise out of living parts and produce action, but that life can never arise out of or produce organization."*

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* Du Droit Naturel, Civil, et Politique, tom. i. 154.

† Series III. Lecture v.

‡ Levit. xvii. 14.

This is a bold speculation, and some part of it is advanced too hastily: for instead of its being true, "that life can never arise out of or produce organization," the most cursory glance into nature will be sufficient to convince every man that organization is the ordinary, perhaps the only, mean by which life is transmitted; and that wherever life appears, its tendency, if not its actual result, is nothing else than organization. But though he failed in his reasoning, he completely succeeded in his facts, and abundantly proved that the blood itself, though a fluid and in a state of circulation, is actually endowed with life; for he proved, first, that it is capable of being acted upon and contracting, like the solid muscular fibre, upon the application of a stimulus; of which every one has an instance in that cake or coagulum into which the blood contracts itself when drawn from the arm, probably in consequence of the stimulus of the atmosphere. He proved, next, that in all degrees of atmospherical temperature whatever, whether of heat or cold, which the body is capable of enduring, it preserves an equality in its own temperature; and in addition to this very curious phænomenon, he proved also, that a new-laid egg, the vessels of which are merely in a nascent state, has a power of preserving its proper temperature, and of resisting cold, heat, or putrefaction, for a considerable period longer than an egg that has been frozen, or in any other way deprived of its vital principle. Thirdly, he proved, in the instance of paralytic limbs, that the blood is capable of preserving vitality when every other part of an organ has lost its vital power, and is the only cause of its not becoming corrupt. Fourthly, that though not vascular itself, it is capable, by its own energy, of producing new vessels out of its own substance, and vessels of every description, as lymphatics, arteries, veins, and even nerves.† Finally, he proved, that the blood, when in a state of health, is not only, like the muscular fibre, capable of contracting upon the application of a certain degree of appropriate stimulus, but that, like the muscular fibre also, it is instantly exhausted of its vital power whenever such stimulus is excessive; and that the same stroke of lightning that destroys the muscular fibre, and leaves it flaccid and uncontracted, destroys the blood, and leaves it loose, and uncoagulated.

Important, however, as these facts are, they do not reach home to the question before us. They sufficiently establish the blood to be alive, but they do not tell us what it is that makes it alive: on the contrary, they rather drive us into a pursuit after some foreign and superadded principle; for that which is at one time alive, and at another time dead, cannot be life itself.

The next theory, therefore, to which I have adverted, undertakes to explain in what this foreign and superadded principle consists. SOME EXQUISITELY SUBTLE GAS OR AURA—some fine, elastic, invisible fluid, sublimed by nature in the deepest and most unapproachable recesses of her laboratory, and spirited with the most active of her energies. An approach towards this hypothesis is also of great antiquity; for it constituted one of the leading features of the Epicurean philosophy, and is curiously developed by Lucretius in his poem on the Nature of Things. According to him, it is a gas or aura, for which in his day there was no name, diffused through every part of the living fabric, swifter and more attenuate than heat, air, or vapour, with all which it concurs in forming the soul or mind as its chief elementary principle :—

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* Hunter on the Blood, p. 20.

† Dr. Munro has proved, that the limb of a frog can live and be nourished, and its wounds heal, without any nerve.

> Far from all vision this profoundly lurks,
> Through the whole system's utmost depth diffus'd,
> And lives as soul of e'en the soul itself.*

But it is to the astonishing discoveries of modern chemistry alone that we are indebted for any fair application of any such fluid to account for the phænomena of life.

Among the numerous gases which modern chemistry has detected, there are three which are pre-eminently entitled to our attention, though they seem to have been glanced at by the Epicureans: caloric, or the matter of heat, chiefly characterized in our own day as a distinct substance, by the labours of Dr. Black and Dr. Crawford: oxygene, or the vital part of atmospheric air, first discovered by Priestley, and explained by Lavoisier: and the fluid which is collected by the Voltaic trough, and which is probably nothing more than the electric fluid under a peculiar form.

Of these caloric, as a distinct entity, was detected first. It was found to be a gas of most astonishing energy and activity, and, at the same time, to be of the utmost consequence to the living substance; to exist manifestly wherever life exists, and to disappear on its cessation. It was hence conceived to be the principle of life itself.

But oxygene began now to start into notice, and the curious and indispensable part it performs in the respiration, as well as in various other functions of both animal and vegetable existence, to be minutely explored and ascertained, and especially by the microscopic eye of M. Girtanner.† The genius of Crawford fell prostrate before that of Lavoisier. Oxygene was now regarded as the principle of life, and heat as its mere attendant or handmaid.

About the year 1790, Professor Galvani, of Bologna, accidentally discovered that the crural nerve of a frog, which had been cut up for his dinner, contracted and became convulsed on the application of a knife wetted with water; and following‡ up this simple fact, he soon discovered also, that a similar kind of contraction or convulsion might be produced in the muscles of other animals, when in like manner prepared for the experiment, not only during life, but for a considerable period after death; and that in all such cases a fluid of some sort or other was either given to the contracting body or taken from it. And Professor Volta, about the same period, succeeded in proving that the fluid thus traced to be given or received was a true electric aura; that it might, in like manner, be obtained by a pile of metallic plates, of two or three different kinds, separated from each other by water, or wetted cloth or wadding; and be so accumulated by a multiplication of such plates, as to produce the most powerful agency in all chemistry. It is not necessary to pursue this subject any farther. Every one in the present day has some knowledge of Galvanism and Voltaism; every one has witnessed some of those curious and astonishing effects which the Voltaic fluid is capable of operating on the muscles of an animal for many hours after death: and it only remains to be added, that since the discovery of this extraordinary power, oxygene has in its turn fallen a sacrifice to the Voltaic fluid, and this last has been contemplated by numerous physiologists as constituting the principle of life; as a fluid received into the animal system from without, and stimulating its different organs into vital action. "The identity," says Dr. Wilson Philip, "of Galvanic electricity and nervous influence is established by these experiments."

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* Nam penitus prorsum latet hæc natura, subestque;
Nec magis hac infra quidquam est in corpore nostro;
Atque anima est animæ proporro totius ipsa.
De Rer. Nat. iii. 274.

† Memoires sur l'Irritabilite, consideree comme principe de vie dans la nature organisee. Paris, 1790.

‡ It is a singular fact, that this identical discovery was not only made, but completed in all its bearings, and by the same means of a recent dissected frog, by Dr. Alexander Stuart, physician to the queen, in 1732, though no advantage was taken of it. A minute account of Dr. Stuart's experiments is given in the Phil. Trans. for 1732.

The result of the whole appears to be, that neither physiology nor chemistry, with all the accuracy and assiduity with which these sciences have been pursued of late years, has been able to arrest or develope the fugitive principle of life. They have unfolded to us the means by which life, perhaps, is produced and maintained in the animal frame, but they have given us no information as to the thing itself: we behold the instrument before us, and see something of the fingers that play upon it, but we know nothing whatever of the mysterious essence that dwells in the vital tubes, and constitutes the vital harmony.

It seems to be on this account, chiefly, that the existence of such a principle as a substantive essence has been of late years denied by MM. Dumas, Bichat, Richerand, Magendie, and, indeed, most of the physiologists of France; whose hypothesis has been caught up and pretty widely circulated in our own country, as though nothing in natural science can be a fair doctrine of belief, unless its subject be matter of clear developement and explanation. But this uncalled for skepticism has involved these philosophers in a dilemma from which it seems impossible for them to extricate themselves, and which we shall have occasion to notice more fully hereafter: I mean the existence of powers and faculties without an entity or substantial base to which they belong, and from which they originate. They allow themselves to employ the term, and cannot, indeed, do without it: but after all they mean nothing by it. "No one in the present day," says M. Richerand, "contests the EXISTENCE OF A PRINCIPLE OF LIFE, which subjects the beings who enjoy it to an order of laws different from those which are obeyed by inanimate beings; by means of which, among its principal characteristics, the bodies which IT ANIMATES are withdrawn from the absolute government of chemical affinities, and are capable of maintaining their temperature at a near degree of equality, whatever be that of the surrounding atmosphere. Its ESSENCE is not designed to preserve the aggregation of constituent molecules, but to collect other molecules which, by assimilating themselves to the organs that IT VIVIFIES, may replace those which daily losses carry off, and which are employed in repairing and augmenting them."* Yet, when we come to examine into the subject more closely, we find that all these terms, so expressive of a specific being and distinct reality—this ESSENCE that VIVIFIES and ANIMATES, has neither being, nor essence, nor vivification, nor animation, nor reality of any kind. That the whole of these expressions are metaphysical; and that the word VITAL PRINCIPLE is not designed to express a distinct being, but is merely an abridged formula, denoting the TOTALITY OF POWERS ALONE which animate living bodies, and distinguish them from inert matter, the TOTALITY OF PROPERTIES and LAWS which govern the animal economy.* So that we have here not only the employment of terms that have no meaning, but properties and laws, powers and principles, without any source,—a superstructure without a foundation,—effects without a cause.

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* "Personne aujourd'hui ne conteste l'EXISTENCE D'UN PRINCIPE DE VIE qui soumet les etres qui en jouissent a un ordre de lois differentes de celles auxquelles obeissent les etres inanimes, force a laquelle on pourroit assigner, comme principaux characteres, de soustraire les corps qu'ELLE ANIME, a l'empire absolu des affinites chimiques, auxquelles ils

But what is this curious and delicate instrument itself?—this machine that so nicely responds to the impressions communicated to it, and visibly envelopes so invisible a constituent?

It is not my intention in this series of popular study to enter into any minute history of the animal frame, but shall confine myself to those general views of it which are requisite to show by what means it is operated upon by the delicate powers we have just contemplated, and the more curious phænomena which result from such an impulse.

The animal frame, then, is a combination of living solids and fluids, duly harmonized, and equally contributory to each other's perfection. The principle of life, whatever it consists of, exists equally in both: in some kinds in a greater, in others in a less degree. In the fluids, Mr. Hunter has traced it down to their first and lowest stage of existence, for he has traced it in the chyle;† and there are evident proofs of its accompanying several of those which are eliminated from the body; in the blood it is found, as we have already had occasion to notice, in a high degree of activity, and probably in a still higher in the nervous fluid.

In the solids it varies equally. There are some in which it can scarcely be traced at all, excepting from their increasing growth, as the cellular membrane, and the bones; in others, we find a perpetual internal activity, or susceptibility to external impressions. But it is in those irritable threads or fibres which constitute the general substance of the muscles or flesh of an animal, that the principle of life exerts itself in its most extraordinary manner, and which it more immediately, therefore, falls within the scope of the present lecture to investigate.

The muscle of an animal is a bundle of these irritable fibres, or soft, red, cylindrical, and nearly inelastic threads, formed out of a substance which the chemists, from the use to which it is applied, denominate fibrine; and which, when examined microscopically, are seen to divide and subdivide, as far as the power of glasses will carry the eye, into minuter bundles of fibrils, or still smaller threads, parallel to each other, and bound together by a delicate cellular web-work, obviously of a different nature.

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auroient tant de tendance a ceder, en virtu de la multiplicite de leurs elemens; et de maintenir leur temperature a un degre presque egal, quelle que soit de d'ailleurs celle l'atmosphere. Son ESSENCE n'est point de conserver l'aggregation des molecules constitutives, mais d'attirer d'autres molecules qui, s'assimilant aux organes qu'ELLE VIVIFIE, remplacent celles qu'entrainent les pertes journalieres, et sont employees a les nourrir et a les accroitre.'—Nouveaux Elemens de Physiologie, tom. i. p. 81. 8vo. Paris, 8vo. 1804.

* "Le mot de PRINCIPE VITAL, force vitale, &c. n'exprime point un etre existant par lui-meme, et independamment des actions par lesquelles il se manifeste: il ne faut l'employer que comme une formule abregee dont on se sert pour designer l'ensemble des forces qui animent les corps vivans et les distinguent de la matiere inerte:—l'ensemble des proprietes et des loix qui regisesent l'economie animale." Id. p. 80.

† On the Blood, p. 91.

They are uniformly accompanied through their course by a number of very minute nerves, which are chords or tubes that originate from the brain, and branch out in every direction, either immediately from the brain itself, or from some part of the spinal marrow, which is a continuation of this organ; by which means a perpetual communication is kept up between the sensorium and the remotest part of the body, as we shall have further occasion to notice hereafter.* Upon the application of any irritating or stimulating power, these fibres immediately contract in their length, and upon the cessation of such power return to their former state of relaxation: and it is chiefly by this curious contrivance that the animal system is enabled to fulfil all its functions. The stimuli by which the fibres, whether of motion or of sensation, are roused into action, are perhaps innumerable in the whole; but a few general classes may easily be devised to comprise all those by which they are ordinarily affected. And while, by an admirable diversity of construction, some sets of fibres are only affected by some sets of stimuli, other sets are only affected by others; and in this manner all the organs are compelled, as it were, to execute the different offices intrusted to them, and no one interferes with that of another. Thus the fibres of the external senses are affected by external objects; they contract and give notice of the presence and degree of power of such objects to the brain, through the medium of the nerves, which, as I have just observed, always accompany them, and which either terminate in or arise from that organ: but while the irritative and sensitive fibres of the ear are excited only by the stimulus of sound, and have no impression produced upon them by that of light, those of the eye are excited only by the stimulus of light, and remain uninfluenced by that of sound: and so of the other organs of external sense. And hence we obtain a knowledge of one set or class of stimuli, which, from their acting upon the organs of sense, are called sensitive stimuli, and the motions to which they give rise, sensitive motions.

Again, the very substances naturally introduced into many of the muscular organs of the body, and especially the hollow muscles, are sufficient to excite them to a due performance of their functions: thus, the lungs are excited to the act of respiration by the stimulus of the air we breathe, the stomach to that of digestion by the stimulus of the food introduced into it; so the heart and blood-vessels are excited by the stimulus of the blood; and the vessels that carry off the recremental materials, by the different stimuli, which these materials contain in themselves. We hence obtain another class of stimuli, which are denominated stimuli of simple irritation; and the motions they produce, simple irritative motions, or motions of irritation.

But the sensory, or brain, which thus receives notice generally, or is imprest upon by the different actions that are perpetually taking place all over the system, through the medium of its own ramifications, or nerves, that uniformly accompany the irritable fibres, in many instances originates motions, and thus proves a stimulus in itself. All voluntary motions are of this kind; the will, which is a faculty of the sensorium, being the exciting cause, and thus giving birth to a third class of stimuli, and of a very extensive range, which are called stimuli of volition. While habit or association becomes, in a variety of instances, a sufficient impulse to other motions, and thus constitutes a fourth class; which are hence named associate stimuli, or stimuli of association.

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* Ser. I. Lect. XV.

But though the muscular fibre is, perhaps, more irritable than any other part of the system, the principle of irritability and a fibrous structure are by no means necessarily connected; for, while the cellular membrane is fibrous but has no irritability whatever, the skin is not fibrous but is highly irritable.

Hence solids and fluids are equally necessary to the perfection of the living system. Food, air, and the ethereal gases, caloric, oxygene, and the medium of electricity, are the stimuli by which it is chiefly excited to action; and, by their combination, contribute in some degree to the matter of the system itself; but of the mysterious power that developes the organs and applies the stimuli, that harmonizes the action and constitutes the life, we know nothing.

We see clearly, however, that the moving powers are, for the most part, the muscles; and it is a subject of perpetual astonishment to the physiologist to observe the prodigious force which these vital chords are made capable of exerting, and the infinite variety of purposes to which they thus become subservient. And were it not that the whole universe swarms with proofs of intelligence and design—were it not that there exists, to adopt the beautiful words of the poet—

> Books in the running brooks,
> Sermons in stones, and good in every thing—

this, perhaps, might be the part of creation which we could best select in proof of the wisdom of the Creator.

It was formerly too much the custom to regard the animal frame as a mere mechanical machine; whence, in that spirit of absurdity with which the wisest of mankind are occasionally afflicted, Descartes affected to believe that brutes are as destitute of consciousness as a block of wood, and that it is exactly the same sort of necessity which drives a dog forward in pursuit of a hare, that compels the different pipes of an organ to give forth different tones upon a pressure of the fingers against its different keys. It is not every one, however, in modern times who has adopted the mechanical theory that has carried it to this extremity of absurdity; but all of them are still carrying it too far who reason concerning the principal motions of the body as mere mechanical motions, and the powers which the muscles exert as mere mechanical powers; in which the bones are the levers, the joints the fulcra, and the muscles the moving cords; for it so happens that all the effects for which the whole of this complicated machinery is absolutely necessary out of the body, are in many instances performed by a single part of it within the body, namely, by the moving cords or muscles alone, without either bones or joints, levers or fulcra. I do not mean to contend that there is no kind of resemblance or conformity of principle between the laws of animate and inanimate mechanics, for I well know that in a variety of points the two systems very closely concur: but I am obliged to contend that they are still two distinct systems, and that in the one case the living power exercises an influence which finds no sort of similitude in the other.

It is indeed curious to observe the difference of result which has flowed from the calculations of the different promoters of this theory; and which alone, were there nothing else to oppose them, would be sufficient to prove the fallacy of their reasoning. Among those who have adopted this mode of explanation, and have perused it with most acuteness, and may be regarded as the fathers of the school, I may be allowed to mention Borelli and Keil; but while the former, in order to account for the circulation of the blood in man, calculated the force with which the heart contracts to be equal to not less than a hundred and eighty thousand pounds weight at every contraction, the latter could not estimate it at more than eight ounces.

In like manner Borelli, in applying the same theory to the power with which the human stomach triturates, or, as we now call it, digests its food, calculated it, in conjunction with the assistance it receives from the auxiliary muscles, which he conceived to divide the labour about equally with itself, as equal to two hundred sixty-one thousand one hundred and eighty-six pounds; and Pitcairn has made it very little less, since he estimates the moiety contributed by the stomach alone at one hundred and seventeen thousand and eighty-eight pounds; which gives to these organs jointly a force more than equal to that of twenty mill-stones! "Had he," said Dr. Monro, "assigned five ounces as the weight of the stomach, he had been nearer the truth."*

The fallacy of this theory, however, and especially as it applies to the stomach, has been completely exposed in our own day, by the well ascertained fact, that though the muscular coat of the stomach in most animals bears some part in the process of digestion, this important operation is almost entirely performed by a powerful chemical solvent secreted by the stomach itself for this very purpose, and hence denominated the gastric juice; and which answers all the purposes of the most violent muscular pressure we can conceive, and with a curious simplicity of contrivance.

The laws of physical force will certainly better apply to the action of the heart and arteries than to that of the stomach, and in some measure assist us in accounting for the circulation of the blood; but the moment we reflect that one half of this very circulation, that I mean which depends upon the veins, and which has for the most part to contend against the attraction of gravitation, instead of being able to avail itself of its assistance, is produced without any muscular propulsion that we are able to discover, and that even the arteries do not, when uninfluenced by pressure, appear to change their diameter in a state of health,† we are necessarily driven to the conclusion, that there is in animal statics, as well as in animal mechanics, a something distinct and independent, and which the laws of physical force are altogether incompetent to explain. Dr. Young, in his excellent Croonian lecture, read before the Royal Society in 1809,‡ has endeavoured to revive the mechanical theory; but he is still compelled to admit a variety of phænomena in the animal machine, and especially in the circulatory system, which are altogether unaccountable upon any of the known principles of common hydraulics, and which can never fail to reduce us to the same result.

So far, therefore, as we at present know, the circulation of the blood is performed by a double projectile power; one moiety being dependent on the action of the living principle in the heart, and perhaps the arteries; and the other moiety on the common law of hydraulics, or the vacuum produced in the heart by that very contraction or systole which has just propelled the blood returned from the lungs into the arterial system. Whence the heart itself becomes alternately a forcing and a suction pump; being the former in respect to the arteries, and the latter in respect to the veins.*

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* Comp. Anat. pref. p. viii. note.

† See Lect. VIII. as also the author's Study of Medicine, vol. ii. p. 16. Edit. second, 1825.

‡ On the Functions of the Heart and Arteries, Phil. Trans. 1809, p. 1.

Upon a moderate estimate, the common labourer may be said to employ a force capable of raising a weight of ten pounds to the height of ten feet in a second, and continued for ten hours a day. A moderate horizontal weight for a strong porter, walking at the rate of three miles an hour, is 200 pounds: the chairman walks four miles an hour, and carries 150 pounds. The daily work of a horse is equal to that of five or six men upon a plane; but from his horizontal figure, in drawing up a steep ascent, it does not exceed the power of three or four men. In working windmills, twenty-five square feet of the sails is equivalent to the work of a single labourer: whence a full-sized mill, provided it could be made to work eight hours a day, would be equivalent to the daily labour of thirty four men. A steam engine of the best construction, with a thirty inch cylinder, has the force of forty horses; and, as it acts without intermission, will perform the work of 120 horses, or of 600 men: every square inch of the piston being equivalent to the power of a labourer.

There are many muscles given to us which the common customs and habits of life seldom render it necessary to exert, and which in consequence grow stiff and immoveable. Tumblers and buffoons are well aware of this fact; and it is principally by a cultivation of these neglected muscles that they are able to assume those outrageous postures and grimaces, and exhibit those feats of agility, which so often amuse or surprise us.

The same muscles of different persons, however, though of the same length and thickness, and so far as we are able to trace, composed of the same number of fibres, are by no means uniformly possessed of the same degree of power; and we here meet with an express deviation from the law of physical mechanics; as we do also in the curious fact, that whatever be the power they possess, they grow stronger in proportion to their being used, provided they are well used, and not exhausted by violence or over exertion.

I have calculated the average weight carried by a stout porter in this metropolis at 200 pounds; but we are told there are porters in Turkey, who, by accustoming themselves to this kind of burden from an early period, are able to carry from 700 to 900 pounds, though they walk at a slower rate, and only carry the burden a short distance. "The weakest man can lift with his hands about 125 pounds, a strong man 400. Topham, a carpenter, mentioned by Desaguliers, could lift 800 pounds. He rolled up a strong pewter dish with his fingers. He lifted with his teeth and knees a table six feet long, with half a hundred weight at the end. He bent a poker, three inches in circumference, to a right angle, by striking it upon his left forearm; another he bent and unbent about his neck, and snapped a hempen rope two inches in circumference. A few years ago there was a person at Oxford who could hold his arm extended for half a minute, with half a hundred weight hanging on his little finger."† We are also told by Desaguliers of a man who, by bending his body into an arch, and having a harness fitted to his hips, was capable of sustaining a cannon weighing two or three thousand pounds. And not many winters ago, the celebrated Belzoni, when first entering on public life, exhibited himself to the theatres of this metropolis, and by a similar kind of harnessing was capable of supporting, even in an upright position, a pyramid of ten or twelve men surmounted by two or three children, whose aggregate weight could not be much less than 2000 pounds; with which weight he walked repeatedly towards the front of the stage.

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* See Stud. of Med. vol. ii. p. 19. edit. second.

† Young's Lect. on Nat. Phil. i. 129.

The prodigious powers thus exerted by human muscles will lead us to behold with less surprise the proofs of far superior powers exerted by the muscles of other animals, though it will by no means lead us to the means of accounting for such facts.

The elephant, which may be contemplated as a huge concentration of animal excellencies, is capable of carrying with ease a burden of between three and four thousand pounds. With its stupendous trunk (which has been calculated by Cuvier to consist of upwards of thirty thousand distinct muscles, it snaps off the stoutest branches from the stoutest trees, and tears up the trees themselves with its tusks. How accumulated the power that is lodged in the muscles of the lion! With a single stroke of his paw he breaks the back-bone of a horse, and runs off with a buffalo in his jaws at full speed: he crushes the bones between his teeth, and swallows them as a part of his food.

Nor is it necessary, in the mystery of the animal economy, that the muscles should always have the benefit of a bony liver. The tail of the whale is merely muscular and ligamentous; and yet this is the instrument of its chief and most powerful attack; and possest of this instrument, to adopt the language of an old and accurate observer,* " a long boat he valueth no more than dust, for he can beat it all in shatters at a blow." The skeleton of the shark is entirely cartilaginous, and totally destitute of proper bone; yet is it the most dreadful tyrant of the ocean: it devours with its cartilaginous jaws whatever falls in its way; and in one of its species, the squalus *carcharias*, or white shark, which is often found thirty feet long, and of not less than four thousand pounds weight, has been known to swallow a man whole at a mouthful.

The sepia *octopodia*, or eight-armed cuttle-fish—the polypus of Aristotle—is found occasionally of an enormous size in the Mediterranean and Indian seas, its arms being at times nine fathoms in length, and so prodigious in their muscular power, that when lashed round a man, or even a Newfoundland dog, there is great difficulty in extricating themselves; and hence the Indians never venture out without hatchets in their boats, to cut off the animal's holders, should he attempt to fasten on them, and drag them under water.

But this subject would require a large volume, instead of occupying the close of a single lecture. Let us turn from the great to the diminutive. How confounding to the skill of man is the muscular arrangement of the insect class! Minute as is their form, there are innumerable tribes that unite in themselves all the powers of motion that characterize the whole of the other classes; and are able, as their own will directs, to walk, run, leap, swim, or fly, with as much facility as quadrupeds, birds, and fishes exercise these faculties separately. But such a combination of functions demands a more complicated combination of motive powers; and what it demands it receives. In the mere larve or caterpillar of a cosus, or insect approaching to the butterfly, Lyonet has detected not less than four thousand and sixty-one distinct muscles, which is about ten times the number that belong to the whole human body; and yet it is probable that these do not constitute any thing like the number that appertain to the same insect in its perfect state. The élator *noctilucus*, or phosphorescent springer, is a winged insect; but it has also a set of elastic muscles, which enable it, when laid on its back, to spring up nearly half a foot at a bound, in order to recover its position. This insect is also entitled to notice in consequence of its secreting a light, which is so much beyond that of our own glow-worm, that a person may see to read the smallest print by it at midnight. The cicada *spumaria*, or spumous grasshopper, is in like manner endowed with a double power of motion; and when attempted to be caught will either fly completely off, at its option, or bound away at the distance of two or three yards at every leap. This insect is indigenous to our own country, and is one of those which in their larve and pupe states discharge, from the numerous pores about the tail, that frothy material upon plants which is commonly known by the name of cuckow-spit.

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* Frederick Martens. See Shaw, II. ii. 489.

Crabs and spiders have a strong muscular power of throwing off an entire limb whenever seized by it, in order to extricate themselves from confinement; and most of them throw off also, once a year, their skin or crustaceous covering, and secrete a new one. The muscular elasticity of the young spider gives it, moreover, the power of wings; whence it is often seen, in the autumn, ascending to a considerable elevation, wafted about by the breeze, and filling the atmosphere with its fine threads. The land-crab (cancer *ruricola*) inhabits the woods and mountains of a country; but its muscular structure enables it to travel once a year to the sea-coast to wash off its spawn in the waters. The spawn or eggs thus deposited sink into the sands at the bottom of the sea, and are soon hatched; after which millions of little crabs are seen quitting their native element for a new and untried one, and roving instinctively towards the wood-lands.

The hinge of the common oyster is a single muscle; and it is no more than a single muscle in the chama gigas, or great clamp-fish, an animal of the oyster form, but the largest testaceous worm we are acquainted with. It has been taken in the Indian ocean of a weight not less than 532 pounds; the fish, or inhabitant, being large enough to furnish 120 men with a meal; and strong enough to lop off a hand with ease, and to cut asunder the cable of a large ship.

Nor is the muscular power allotted to the worm tribes less wonderful than that of insects, or its variety less striking or appropriate. The leech and other sucker-worms are as well acquainted with the nature of a vacuum as Torricelli; and move from place to place by alternately converting the muscular disks of their head and tail into air-pumps.

The sucker of the cyclopterus, a genus of fishes denominated suckers from their wonderful adhesive property, is perhaps the most powerful, for the size of the fish, of any we are acquainted with; and is formed, at will, by merely uniting the peculiar muscles of its vental fins into an oval concavity. In this state, if pulled by the tail, it will raise a pailful of water, rather than resign its hold.

The teredo *navalis*, or ship-worm, is seldom six inches in length, but the muscles and armour with which its head is provided enables it to penetrate readily into the stoutest oak-planks of a vessel, committing dreadful havoc among her timbers, and chiefly producing the necessity of her being copper bottomed. This animal is a native of India; it is gregarious, and always commences its attack in innumerable multitudes; every worm, in labouring, confining itself to its own cell, which is divided from that of the next by a partition not thicker than a piece of writing paper. The seaman, as he beholds the ruin before him, vents his spleen against the little tribes that have produced it, and denounces them as the most mischievous vermin in the ocean. But a tornado arises—the strength of the whirlwind is abroad —the clouds pour down a deluge over the mountains—and whole forests fall prostrate before its fury. Down rolls the gathering wreck towards the deep, and blocks up the mouth of that very creek the seaman has entered, and where he now finds himself in a state of captivity. How shall he extricate himself from his imprisonment ?—an imprisonment as rigid as that of the Baltic in the winter season. But the hosts of the teredo are in motion :—thousands of little augers are applied to the floating barrier, and attack it in every direction. It is perforated, it is lightened, it becomes weak ; it is dispersed, or precipitated to the bottom ; and what man could not effect, is the work of a worm. Thus it is, that nothing is made in vain ; and that in physics, as well as in morals, although evil is intermingled with good, the good ever maintains a predominancy.

LECTURE XI.

ON THE BONES, CARTILAGES, TEETH, ARTICULATION, INTEGUMENTATION, HAIR, WOOL, SILK, FEATHERS, AND OTHER HARD OR SOLID PARTS OF THE ANIMAL FRAME.

In a former lecture we took a general survey of the characteristic features that distinguish the unorganized from the organized world, and the vegetable kingdom from the animal : we examined into the nice structure of plants, and the resemblances which they bear to the animated form. In our last lecture we proceeded to an inquiry into the nature of the living principle, took a glance at a few of the theories that have been invented to explain its essence and mode of operation, and contemplated the origin and powers of the muscular fibre, which may be denominated its grand executive organ.

The muscles of an animal, however, are not the only instruments of animal motion ; the bones, cartilages, and ligaments contribute very largely to the action, and the skin is not unfrequently a substitute for the muscle itself. These, therefore, as well as a variety of other bodies minutely connected with them, or evincing a similarity of construction,—as the teeth, hair, nails, horns, shells, and membranes,—are now to pass under our review, and are entitled to our closest attention ; and I may add, that their diversity of uses and operations, and the curious phænomena to which they give rise, are calculated to afford not less amusement than instruction.

I had occasion to remark lately,* that lime is a substance absolutely necessary to the growth of man. It is, in truth, absolutely necessary to the growth of almost all animals ; even soft-bodied or molluscous worms, except in a few instances, are not free from it ; nay, even infusory animals, so minute as to be only discerned by the microscope, still afford a trace of it in the calcareous speck which constitutes their snout : but it is in the bones and shells of animals that lime is chiefly to be found; and hence those animals possess most of it in whom these organs are most abundant.

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* Series I. Lect. VI. On Geology, p. 65, and passim ; and Lect. VIII. On Organized Bodies, and the Structure of Plants compared with that of Animals.

Bone, shell, cartilage, and membrane, however, in their nascent state, are all the same substance, and originate from a viscid fluid, usually supposed to be the coagulable lymph, or more liquid part of the blood; which, secreted in one manner, constitutes jelly, or gelatine, a material characterized by its solubility in warm water, heated to about half the boiling point; and, secreted in another manner, forms albumen, or the material of the white of the egg, characterized by its coagulating instead of dissolving in about the same heat: the difference, however, between the two, consisting merely, perhaps, in the different proportion of oxygene they contain. Membrane is gelatine, with a small proportion of albumen to give it a certain degree of solidity; cartilage is membrane, with a larger proportion of albumen to give it a still greater degree of solidity; and bone and shell are mere cartilage, hardened by the insertion of lime into their interior, the lime being secreted for this purpose by a particular set of vessels, and absorbed by the bony or shelly rudiments in their soft state. And hence any substances which, like the mineral acids for example, have a power of dissolving the earthy matter of the two last, and of leaving the cartilage untouched, may be readily employed as re-agents, to reduce them to their primary softness: and it was by this means that Cleopatra, as we are told by Pliny, dissolved one of the costly pair of pearls that formed her earrings, each of which was valued at upwards of eighty thousand pounds (*centies sestertium*), at a feast given to Marc Antony, and then presented it to him in a goblet, with an equal mixture of wine.*

In the adult state, however, as well as in the embryo state, it is necessary that the bones, like every other substance of the animal frame, should be punctually supplied with the elementary matter, or the means of forming the elementary matter, of which it essentially consists, the old matter of every kind being worn out by use, and carried away by a distinct set of vessels, called lymphatics or absorbents. It is the office of the digestive organs to receive such supply from without, and to prepare it for the general use. And hence, if we could conceive it possible for these organs, or any organs dependent upon them, to be so peculiarly diseased as to be incapable of preparing or conveying to the bones a sufficient quantity of lime, (of which some portion is contained in almost every kind of food,) to supply the place of that which is perpetually passing off, the necessary consequence would be, that the bones would progressively lose their hardness, and become cartilaginous and pliable. Now we sometimes do meet with the digestive or the secretory organs affected by such a kind of disease, and that both in children and adults. In children it is more common, and is called RICKETS; in grown persons it is simply called a SOFTNESS OF THE BONES, or MOLLITIES OSSIUM. In the former case, the softened spine becomes bent from the weight of the head, and other extremities, which it is now no longer able of sustaining, while the chest and most of the limbs partake of the general distortion. In the latter case many of the bones are sometimes reduced to imperfect cartilages, and can be bent and unbent in any direction.

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* This was on a trial who could give the most sumptuous banquet. Munacius Plancus was the arbiter. The expense of Marc Antony's, already bestowed, had been valued at just the price of this single pearl. Cleopatra was proceeding to dissolve its fellow, when she was suddenly stopped by the umpire, who declared the victory to be her's. Plin. Hist. Nat. lib. ix. 25.

Lime, however, is never found in the animal system in its pure state, and is certainly never introduced into it in such a state. It is usually combined with some acid, either the phosphoric, in which case the compound is called phosphate of lime, or carbonic acid gas, when it is called carbonate of lime, or common chalk.

It is of no small importance to attend to the nature of these two acids; for it is the difference between them that chiefly constitutes the difference between bones and shells; bones uniformly consisting of a larger proportion of phosphate of lime, or lime and phosphoric acid, and a less proportion of carbonate; and shells of a larger proportion of carbonate of lime, and a less proportion of phosphate. There are a few other ingredients that enter into the composition of both these substances, and which are chiefly obtained from the materials of common salt, as sulphuric acid and soda; but the proportions are too small to render it necessary to dwell upon them in a course of popular study. Bones, shells, cartilages, and membranes may therefore be regarded as substances of the same kind, differing only in degree of solidity from the different proportions that they possess of albumen and salts of lime.

Teeth, horn, coral, tortoise-shell, fish-scales, and the crustaceous integuments of crabs, millepedes, and beetles, are all compounds of the same elements combined in different proportions, and rendered harder or softer as they possess a larger or smaller quantity of calcareous salts; ivory and the enamel of teeth possessing the largest quantity, and consisting almost exclusively of phosphate of lime, with a small proportion of animal matter.

The gelatine and albumen are unquestionably generated in the animal system itself from the different substances it receives under the form of food; and it is curious to observe the facility and rapidity with which some animals are capable of producing them. The gastrobranchus *cæcus*, or hag-fish, a small lamprey-like animal of not more than eight inches long, will convert a large vessel of water in a short period of time into size or mucilage, of such a thickness that it may be drawn out in threads. The form and habits of this little animal are singular: Linnéus regarded it as a worm; but Bloch has removed it, and with apparent propriety, into the class of fishes. It is a cunning attendant upon the hooks of the fisherman; and as soon as it perceives a larger fish to be taken, and by its captivity, rendered incapable of resistance, it darts into its mouth, preys voraciously, like the fabled vultures of Prometheus, on its inside, and works its way out through the fish's skin.

But though gelatine and albumen are unquestionably animal productions, the one a secretion from the blood, and the other a constituent principle of it, there is a doubt whether lime ought ever to be regarded in the same character. A very large portion is perpetually introduced into the stomach from without. In our lecture on the analogy between the structure of plants and of animals,* I had occasion to observe, that it forms an ingredient in common salt; not, indeed, necessarily so, but from the difficulty of separating the other ingredients from their combination with it: yet it enters not more freely into common salt than into almost every other article, whether animal, vegetable, or mineral, of which our diet is usually composed. And upon this common fact it is more generally conceived at present, to be a substance communicated to the animal frame, than generated by it.

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* Ser. I, Lect. VIII.

This opinion, however, is by no means established ; and there are many circumstances that may lead us to a contrary conclusion. Though almost every kind of food contains some portion of lime, it by no means contains an equal portion ; and yet we find that a healthy young animal, whatever be the sort of food on which it is fed, will still provide lime enough from some quarter or other to satisfy the demand of its growing bones, and to maintain them in a due degree of solidity and hardness.

Again, the soil of some countries, as the mountains of Spain, for example, consists almost entirely of gypsum or some other species of limestone ; while in other countries these are substances very rarely to be met with. It is a curious fact, that in that vast part of the globe which has been latest discovered, and to which modern geographers have given the name of Australia, comprising New Holland and the islands with which its shores are studded, not a single bed or stratum of limestone has hitherto been detected, and the builders are obliged to make use of burnt shells for their mortar, for which I have lately advised them to substitute burnt coral.* Now, it would be natural to suppose that the animals and vegetables of such a country would partake of the deficiency of its soil, and that the shells and bones which it produces would be less compact in their texture than those of other countries ; yet this supposition is not verified by fact : nature is still adequate to her own work ; the bones of animals are as indurated and perfect in these regions as in any parts of the old world ; while the shells are not only as perfect, but far more numerous ; and the frequent reefs of coral, altogether an animal production, that shoots forth from the shores in bold and massy projections, prove clearly that a coral rock, largely as it consists of lime, forms the basis of almost every island.

The prodigious quantity of lime, moreover, that is secreted by some animals at stated periods, beyond what they secrete at other times, seems to indicate a power of generating this earth in their own bodies. The stag, elk, and several other species of the deer tribe, cast their antlers annually, and renew them in full perfection in about twelve weeks. These antlers are real bones ; and those of the elk are sometimes as heavy as half a hundred pounds weight, and in a fossil state in Ireland have been dug up still heavier, and of the enormous measure of eight feet long, and fourteen feet from tip to tip ; on beholding which, we may well, indeed, exclaim with Waller,—

> O fertile head ! which every year
> Could such a crop of wonders bear.

In like manner, many species of the crab and lobster tribes annually throw off and renew the whole of their crustaceous covering, and apparently without any very great degree of trouble. The animal at this time retires to some lonely, and sheltered place, where in its naked and defenceless state, it may avoid the attack of others of the same tribe which are not in the same situation : a line instinctively drawn now separates the shell into two parts, which are easily shaken off, when the secernent vessels of the skin pour forth a copious efflux or sweat of calcareous matter all over the body, the more liquid parts of which are as rapidly drunk up by the absorbent vessels, so that a new calcareous membrane is very soon produced, which as speedily hardens into a new calcareous crust, and the entire process is completed in about a fortnight. This genus, also, in many of its species, is capable of reproducing an entire limb, with the whole of its calcareous casing, whenever deprived of it by accident or disease, or it voluntarily throws it off, as I have already observed it is capable of doing, to extricate itself from being seized hold of: though the new limb is seldom so large or powerful as the original. So, in other animals we sometimes find a large and preternatural secretion of calcareous matter, in consequence of a diseased habit of particular organs, or of the system generally. The human kidneys are too often subject to a morbid affection of this kind, whence a frequent necessity for one of the most painful operations in surgery. The chalk-stones, as they are erroneously called, that are often produced in protracted fits of gout and rheumatism, are rather lithate of soda than any compound of lime ; but instances are not wanting in which one of the lungs has been found converted into an entire quarry of limestone.

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* It is understood that some beds of chalk have since been discovered on the farther side of the Blue Mountains ; but none is still to be traced on the hither side, in any of the settlements of the colony.

In the Transactions of the Royal Society there are several cases related of young persons who, in consequence of a morbid habit, threw out a variety of calcareous excrescences, either over the hands or feet, or over the whole body ;* and about four years since, a Leicestershire heifer was exhibited for a show in this metropolis, the head and neck of which were completely imbedded in horny excrescences of this kind, and the back and limbs profusely sprinkled over with them : some of the horns, and especially those about the dew-lap, were as long and as large as the natural horns of the forehead, but they were much more calcareous and brittle. A calcareous scurf, moreover, was secreted over every part of the skin, which, whenever the skin was scratched or bitten, united with the fluid that oozed forth, ramified, and divaricated into masses of small roses. At the request of the proprietor I took an account of this extraordinary animal, and have since communicated it to the Royal Society. In all other respects it was in good health ; its size was proportionate to its age, and its appetite enabled it to digest foods of every kind equally ; and though, in consequence of this, its diet had been frequently varied, the propensity to a secretion of calcareous matter continued the same under every change.

It appears, therefore, very doubtful whether the animal economy be not at times capable of generating lime, as well as gelatine or albumen, out of the different materials introduced into the stomach in the form of food. Vauquelin endeavoured to decide the question by a variety of experiments upon the nature of the egg-shells of a sitting hen, and an examination into the proportion of calcareous matter contained in a given weight of shells, compared with the calcareous matter furnished by her food, and that discharged as a recrement ; and, so far as these experiments go, they support the opinion of a generation of lime, and that in very considerable abundance, the weight secreted appearing to have been five times as much as that introduced into the stomach. But to determine the question incontrovertibly requires so nice a precision in the mode of conducting such experiments, as, from a variety of circumstances, it seems almost impossible to attain.

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* See also Mr. Baker's account of the porcupine-man, Phil. Trans. for 1755.

It is to the power which the living principle possesses, either of secreting or generating the substance of lime by its natural action, that we are indebted for all those elegant shells that enrich the cabinet of the conchologist, and seem to vie with each other in the beauty of their spots, the splendour and irridescence of their colours, and the graceful infliction of their wreaths. And it is to the power which the same principle possesses, of forming this substance by a morbid action, that we owe not only those unsightly excrescences I have just mentioned, but some of the most costly ornaments of superstition or luxury: those agate-formed bezoards which in Spain, Portugal, and even Holland, were lately worn as amulets against contagion, and which have been let out for hire at a ducat a day, and been sold as high as three hundred guineas a piece; and those delicate pearls which constitute an object of desire among the fair sex of every country, and which give additional attraction to the most finished form.

The first are usually obtained from the stomach or intestines of the goat or antelope; in the latter case being called oriental bezoards, and possessing the highest value. The most esteemed are those obtained from the stomach of that species of the oriental antelope called the gazel, to which the Persian and Arabian poets are perpetually adverting whenever they stand in need of an image to express elegance of form, fleetness of speed, or captivating softness of the eyes. The second are obtained from the inside of the shells of the mytilus *margaritiferus* and mya *margaritifera*, pearl-muscle and pearl-oyster: the former, producing the largest, and consequently, the richest, is found most commonly on the coast of Ceylon; the latter not unfrequently on that of our own country, and was traced some centuries ago in great abundance in the river Conway in Wales. Linnéus is said to have been acquainted with a process by which he could excite at pleasure a secretion of new pearls in the pearl-oysters which he kept in his reservoirs. It is generally supposed to be a diseased secretion, somewhat similar to that of the stone in the human bladder.

The murex *tritonis*, or musical murex, is here also worth noticing. Its calcareous shell is ventricose, oblong, smooth, with rounded whorls, toothed aperture, and short beak, about fifteen inches long, white, and appearing as if covered with brown, yellow, and black scales. It inhabits India and the South Seas, and is used by the New Zealanders as a musical shell, and by the Africans and many nations of the East as a military horn.

Before we quit this subject, I will just observe, that it is to the same tribe we are indebted for our nacre or mother-of-pearl, which is nothing more than the innermost layers of the shell, in which the morbid works or concretions which we call pearls lie imbedded; and that to the same order of shells the Indians owe their wampum or pieces of common money, which are formed of the Venus *mercenaria*, or clam-shell, found in a fossil state; and that our own heralds owe the scallop, ostrea *maxima*, that so often figures in the field of our family arms, and was formerly worn by pilgrims on the hat or coat, in its natural state, as a mark that they had crossed the sea for the purpose of paying their devotions at the Holy Land.

From these facts and observations we cannot but behold the great importance of lime in the construction of the animal frame, the extensive use which is made of it, and the variety of purposes to which it is applied: combined in different proportions with gluten and albumen it affords equally the means of strength and protection, produces the bones within and the shells without, the external and internal skeleton, and is discoverable in every class, order, and even genus of animals, except a very few of the soft worms and insects in their first and unfinished state.

It is hence the cerambyx, and several other tribes of insects, are able to make that shrill sound which they give forth on being taken, and which appears like a cry from the mouth, but is in reality nothing more than the friction of the chest of the insect against the upper part of its abdomen and wing-shells. And it is hence, also, that the ptinus *fatidicus*, or death-watch, produces those measured strokes against the head or other part of a bed in the middle of the night, which are so alarming to the fearful and superstitious; but which in truth are nothing more than a call or signal by which the one sex is enticed to the other, and is merely produced by the insect's striking the bony or horny front of its head against the bed-post, or some other hard substance.

Having, then, taken a brief survey of the elementary nature and chemical composition of these harder parts of the animal frame, I shall proceed to make a few remarks upon the relative powers of each, and their diversified applications amid the different kinds of animals in which they are employed.

The BONES in their colour are usually white; but this does not hold universally, for those of the gar-pike (esox *Belone*) are green; and in some varieties of the common fowl they approach to a black: Abelfazel remarks this of the fowls of Bera, and Niebuhr of those of Persepolis.

The bones of an animal, wherever they exist, are unquestionably the levers of its organs of motion: and so far the mechanical theorists are correct. In man and quadrupeds, whose habits require solidity of strength rather than inflexibility of accommodation, they are hard, firm, and unpliant, and consist of gluten fully saturated with phosphate and carbonate of lime. In serpents and fishes, whose habits, on the contrary, demand flexibility of motion, they are supple and cartilaginous; the gluten is in excess, and the phosphate of lime but small in proportion to it, and in some fishes altogether deficient in the composition of their skeleton, though still traceable in their scales and several other parts. In birds, whose natural habits demand levity, the bones are skilfully hollowed out and communicate with the lungs, and instead of being filled with marrow are filled with air, so that the purpose for which the structure of birds was designed is as obvious, and as deeply marked, in the bones as in the wings, whose quills also are for the same reason left hollow, or rather are filled with air, and in many tribes communicate with the lungs as the bones do.

The skeleton of the cuttle-fish (sepia *officinalis*) is extremely singular; its back-bone, for some purpose unknown to us, is much broader than that of any other aquatic animal of the same size, and of course would be much heavier but for a curious contrivance to prevent this effect, which consists in its being exquisitely porous and cellular, and capable, like the bones of birds, of becoming filled with air, or exhausted of it, at the option of the animal, in order to ascend or descend with the greater facility. It is an animal of this kind, or closely akin to it,* that inhabits the shell of the beautiful paper-nautilus, and still more beautiful pearl-nautilus (argonauta and nautilus tribes,) and which hence obtain no inconsiderable portion of that lightness which enables them, with their extended sails, to scud so dexterously before the wind. In the calamary (sepia *Loligo*) we meet with an approach towards the same contrivance, in a kind of leafy plate introduced into the body of the animal; and even in the cloak of the slug tribe we trace something of the same sort, though proportionably smaller, and verging to the nature of horn.

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* The animal has commonly been supposed to be a real sepia or cuttle-fish; but several naturalists have of late doubted this, inasmuch as there are a few marks of distinction that seem to take it out of this genus. Rafinesque has hence made another genus, for the purpose of receiving those which possess these distinctive signs; and Dr. Leach has lately distinguished it specifically, in consequence of specimens sent home from the unfortunate Congo expedition, as collected by Cranch, by the name of Ocythœ *Cranchii*. Even this animal, however, is regarded as a parasite in the shell, and only possessing it when empty. The proper animal is not known to the present hour. See Phil. Trans. 1817, p. 293.

Generally speaking, the bones grow cartilaginous towards their extremities, and the muscles tendinous; by which means the fleshy and osseous parts of the organs of motion become assimilated, and fitted for that insertion of the one part into the other upon which their mutual action depends. The extent and nature of the motion is determined by the nature of the articulation, which is varied with the nicest skill to answer the purpose intended. In ostraceous worms the only articulation is that of the hinge: in the cancer tribes the tendon is articulated with the crust, whence the wonderful strength and activity of the claws; and it is articulated in a similar manner with the scaly plates of some species of the tortoise. In insects the part received and the part receiving form each a segment of a spheroid; whence the motion may be either rotatory or lateral, at pleasure. In mammalian animals the lower jaw only has a power of motion; but in birds, serpents, and fishes the upper jaw in a greater or less degree possesses a similar power.

The motion of serpents is produced, according to Sir Everard Home, by their ribs, which for the most part accompany them, not only as organs of respiration, but from the hind extremity to the neck, and are possest of a peculiar power of motion by means of peculiar muscles. "The vertebræ are articulated by ball and socket-joints (the ball being formed upon the lower, and the socket on the upper one), and have therefore much more extensive motion than in other animals." In the draco *volans* the skeleton of the wings is formed out of ribs which "are superadded for this purpose, and make no part of the organs of respiration; the ribs in these animals appear to work in succession, like the feet of a caterpillar."

The TEETH vary in their form and position almost as much as the bones. Where jaw-bones exist they are usually fixt immoveably in their sockets; but in some animals a few of them are left moveable, and in others the whole. The mus *maritimus*, or African rat, the largest species of this genus which has hitherto been discovered, and seldom less than a full-sized rabbit, has the singular property of separating at pleasure to a considerable distance the two front-teeth of the lower jaw, which are not less than an inch, and a quarter long. That elegant and extraordinary creature the Kangaroo, which, from the increase that has lately taken place in his Majesty's gardens at Kew, we may soon hope to see naturalized in our own country, is possessed of a similar faculty. And the hollow tusks or poisoning fangs of the rattlesnake, and other deadly serpents, are situated in a peculiar bone on each side of the upper jaw, so articulated with the rest, that the animal can either depress or elevate them at his option. In a quiescent state they are recumbent, with their points directed inwards; but whenever the animal is irritated he instantly raises them; and at the moment they inflict a wound, the poison, which lies in the reservoir immediately below, is injected through their tubes by the act of pressure itself.

In the shark and ray genera the whole of the teeth are moveable, and lie imbedded in jaw-cartilages instead of in jaw-bones, and like the fangs of the poisonous serpents are raised or depressed at pleasure. The teeth of the xiphias *Gladius*, or sword-fish, are similarly inserted; while his long sword-like snout is armed externally, and on each side, with a taper row of sharp, strong, pointed spines or hooks, which are sometimes called his teeth, and which give rise to his popular name.

The ant-eater and manis swallow their aliment whole: and in many animals the jaws themselves perform the office of teeth, at least with the assistance of the tongue. In birds this is generally the case, sometimes in insects, whose jaws are for this purpose serrated or denticulated at the edge, and frequently in molluscous worms. The jaws of the triton genus act like the blades of a pair of scissors. The snail and slug have only a single jaw, semilunar in its form, and denticulated: but the mouth of the nereis has several bony pieces. The sea-mouse (aphrodita *aculeata*) has its teeth, which are four, fixed upon its proboscis, and is of course able to extend and retract them at pleasure; and the leech has three pointed cartilaginous teeth, which it is able to employ in the same way, and by means of which it draws blood freely. In like manner, though insects chiefly depend upon a serrated jaw, yet many of them are also possessed of very powerful fangs, of which we have a striking instance in the aranea *avicularia*, or bird-spider, an inhabitant of South America, found among trees, and a devourer of other insects and even small birds. It is of so enormous a size that its fangs are equal to the talons of a hawk; and its eyes, which are eight in number, arranged as a smaller square in the middle of a larger, are capable of being set in the manner of lenses, and used as microscopes.

In many animals, especially the herbivorous, the tongue itself is armed with a serrated apparatus, the papillæ being pointed and recurvated, and enabling them to tear up the grass with much greater facility. In the cat-kind the tongue is covered with sharp and strong prickles, which enable the animal to take a strong hold; and similar processes are met with in the bat and the opossum. In the lamprey and myxine families, the tongue itself is covered with teeth. In that grotesque and monstrous bird the toucan, whose bill is nearly as large as its whole body, the tongue is lined with a bundle of feathers, of the use of which, however, we are totally ignorant, though it is probably an organ of taste.

In the crab and lobster tribes the teeth are placed in the stomach, the whole of which is a very singular organ. It is formed on a bony apparatus, and hence does not collapse when empty. The teeth are inserted into it round its lower aperture or pylorus: their surface is extremely hard, and their margin serrated or denticulated, so that nothing can pass through the opening without being perfectly comminuted. The bones and teeth are moved by peculiar muscles. It is a curious fact, that at the time the animal throws off its shell, it also disgorges its bony stomach and secretes a new one.

The teeth of the cuttle-fish are arranged not very differently, being situated in the centre of the lower part of the body; they are two in number, and horny, and in their figure exactly resemble the bill of a parrot.

The teeth of the echinus genus (sea-hedge-hog) are of a very singular arrangement. A round opening is left in the centre of the shell for the entrance of the food: a bony structure, in which five teeth are inserted, fills up this aperture; and as those parts are moveable by numerous muscles, they form a very complete organ of mastication.

Such is the variety which the hand of nature, sometimes, perhaps, sportive, but always skilful, has introduced into the structure and arrangement of the teeth of animals, or the organs that are meant to supply their place.

The SKIN AND ITS APPENDAGES offer an equal diversity, and constitute the next subject of our inquiry.

All living bodies, whether animal or vegetable, are furnished with this integument: in all of them it is intended as a defence against the injuries to which, by their situation, they are commonly exposed; and in most of them it also answers the purpose of an emunctory organ, and throws off from the body a variety of fluids, which either serve by their odour to distinguish the individual, or are a recrement eliminated from its living materials.

This integument accompanies animals and vegetables from their first formation: it involves equally the seed and the egg; and possessing a nature less corruptible than the parts it encloses, often preserves them uninjured for many years, till they can meet with the proper soil or season for their healthy and perfect evolution.

This is a curious subject, and must not be too hastily passed over. After fish-ponds have been frozen to the very bottom, and all the fishes contained in them destroyed; or after they have been completely emptied, and cleared of their mud; eels and other fishes have been again found in them, though no attempt has been made to re-stock the ponds. Whence has proceeded this reproduction? Many of the ancient schools of philosophy, and even some of those of more modern date, refer us to the doctrine of spontaneous generation, and believe that they have here a clear proof of its truth. But this is to account for a difficulty by involving ourselves in one of a much greater magnitude. It is a *petitio principii* which we stand in no need of, and which we should be careful how we concede. The reproduced fishes have alone arisen from the ova of those which formerly inhabited the fish-pond; and which, from some cause or other, had sunk so deep into the soil, as to be beyond the germinating influence of the warmth and air contained in the supernatant water, communicated to it by the sun and the atmosphere. But the indestructible texture of the integument which enclosed the fecundated ova has preserved them, perhaps for years, from injury and corruption; and they have only waited for that very exposure to light, air, and warmth, which the removal of the superior stratum of mud has produced, to awaken from their dormant state into life, form, and enjoyment; and but for which they would have remained in the same state, dormant but not destroyed, for ten or twelve times as long a period.

So, in the hollows upon our waste lands, when they have been for some time filled with stagnant water, we not unfrequently find eels, minows, and other small species of the carp genus, leeches* and water insects, and wonder how they could get in such a situation. But the mud which has been emptied out of the preceding fish-pond has perhaps been thrown into these very hollows; or the ova of the animals have been carried into the same place by some more recondite cause; and they have been waiting, year after year, for the accidental circumstance which has at length arrived, and given them the full influence of warmth, water, light, and air.

The ova of many kinds are peculiarly light, and almost invisibly minute. They are hence, when the mud, which has been removed from fish-ponds, becomes dry and decomposed into powder, swept by the breeze into the atmosphere, from which they have occasionally descended into the large tanks which are made in India as reservoirs for rain-water: and producing their respective kinds in this situation, have appeared, to the astonishment of all beholders, to have fallen from the clouds with the rain itself. Dr. Thomson, in adverting to this curious fact, observes that it is difficult to account for it satisfactorily.* The explanation now offered will, if I mistake not, sufficiently meet the case.

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* See Wild. p. 120. note.

Many insects can only be hatched in a particular animal organ; and it is the office of the integument of the ovum to preserve it in a perfect state till it has an opportunity of reaching its proper nidus. Thus the horse-gadfly, or oestrus *equi*, deposites its eggs on the hairs of this animal, and sticks them to the hair-roots by a viscous matter which it secretes for this purpose. But here they could never be hatched, though they were to remain through the whole life of the horse: their proper nidus is the horse's stomach or intestines, and to this nidus they must be conveyed by some means or other; and in their first situation they must remain and be preserved, free from injury and corruption, till they can obtain such a conveyance. The integument in which they are wrapped up gives them the protection they stand in need of; and the itching which they excite in the horse's skin compels him to lick the itching part with his tongue; and by this simple contrivance the ova of the gadfly are at once conveyed to his mouth, and pass with the food into the very nidus that is designed for them.

It is the same integument that, by its incorruptibility, preserves the caterpillar during the torpitude of its chrysalid state, while suspended by a single thread from the eaves of an incumbent roof; and which thus enables the worm to become transformed into a butterfly. The larve of the gnat, when approaching the same defenceless state, dives boldly into the water, and is protected by the same indestructible sheath from the dangers of an untried element.

In several species the insect remains in its chrysalid state for many years: the locust, in one of its species at least, the cicada *septendecim*, appears *in numbers* once only in seventeen years, and the palmer-worm once only in thirty years; cycles not recognised by the meteorologist, but which are well entitled to his attention: and, through the whole range of their duration, it is the integument we are now speaking of that furnishes the animal with a secure protection.

Whence comes it that plants of distant and opposite climates (for every climate has its indigenous plants as well as its indigenous animals,) should so frequently meet together in the same region? that those which naturally belong to the Cape of Good Hope should be found wild in New Holland? and those of Africa on the coast of Norway? and that the Floras of every climate under the heavens should consociate in the stoves and gardens of our own country? it is the imperishable nature of the integument that surrounds their seeds by which this wonder is chiefly effected. Some of these seeds are provided with little hooks, and fasten themselves to the skins of animals, and are thus carried about from place to place; others adhere by a native glue to the feathers of water-fowls, and are washed off in distant seas; while a third sort are provided by nature with little downy wings, and hence rise into the atmosphere, and are blown about by the breeze towards every quarter of the compass. Of this last kind is the light seed of the betula *alba*, or birch-tree; which, in consequence, is occasionally seen germinating on the summit of the loftiest rocks and the tops of the highest steeples.[*] But it is to man himself that this dissemination of plants is chiefly owing. He who in some sort commands nature—who changes the desert into a beautiful landscape—who lays waste whole countries, and restores them to their former fruitfulness—is the principal instrument of enriching one country with the botanical treasures of all the rest. Wars, migrations, and crusades, travel, curiosity, and commerce, have all contributed to store Europe with a multitude of foreign productions, and to transplant our own productions into foreign quarters. Almost all the culinary plants of England, and the greater number of our species of corn, have reached us from Italy or the East;[†] America has since added some; and it is possible that Australia may yet add a few more.

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* Annals of Philos. viii. p. 70.

The utmost period of time to which seeds may hereby be kept, and be enabled to retain their vital principle, and consequently their power of germination, has not been accurately determined, but we have proofs enough to show that the duration may be very long. Thus, M. Triewald relates that a paper of melon-seeds, found in 1762, in a cabinet of Lord Mortimer, and apparently collected in 1660, were then sown and produced flowers and excellent fruit;[‡] and Mr. R. Gale gives an instance of a like effect from similar seeds after having been kept thirty-three years.[§]

M. Saint-Hilaire sowed various seeds belonging to the collection of Bernard de Jussieu, forty-five years after the collection had been made. They consisted of three hundred and fifty distinct species; of these many, though not the whole, proved productive. In some the cotyledon appeared to have nearly, but not entirely, perished; in which, therefore, though the seeds swelled, and promised fairly at first, they died away gradually. And as it is a well-known fact that melons improve from seeds that have been kept for two or three years, he conceives that in this case the cotyledons have been ripened during such period.[||]

Animal seeds or eggs, when perfectly impregnated, appear capable of preservation as long. Bomare, indeed, affirms, that he himself found three eggs, which, protected from the action of the air, had continued fresh in the wall of a church in which they must have remained for a period of *three hundred years*.[¶]

The integument which covers seeds, eggs, insects, and worms, seldom consists of more than two distinct layers, and is sometimes only a single one; but in the four classes of red-blooded animals it consists almost uniformly of three layers, which are as follows: first, the true skin, which lies lowermost, is the basis of the whole, and may be regarded as the condensed external surface of the cellular substance, with nerves, blood-vessels, and absorbents interwoven in its texture; secondly, a mucous web (rete mucosum), which gives the different colours to the skin, but which can only be traced as a distinct layer in warm-blooded animals; and, thirdly, the cuticle, which covers the whole, and is furnished in the different classes with peculiar organs for the formation and excretion of a variety of ornamental or defensive materials—as hairs, feathers, wool, and silk.

The CUTIS, OR TRUE SKIN, is seldom uniformly thick, even in the same animal: thus, in man, and other mammals, it is much thicker on the back than in the front of the body; but in the different classes or genera of animals it offers us every possible variety. Generally speaking, it is thinnest in birds, excepting in the duck tribe and in birds of prey. Its consistency and elasticity in horses, oxen, sheep, and other cattle, render it an object of high value, and lay a foundation for a variety of our most important trades and manufactures. In many animals it is so thick and tough, as to be proof against a musket-ball. It is sometimes found so in the elk, but usually so in the elephant, which, at the same time, possesses the singularity of being sensible to the sting of flies. The skin of the rhinoceros despises equally the assault of swords, musket-balls, and arrows.

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[*] There is an interesting article on this subject published long since the above was delivered, an account of which may be found in the Journal of Science and the Arts, No. vii. p. 3.

[†] Wildenow, Principles, &c. § 357.

[‡] Phil. Trans. vol. xliii.

[§] Id. vol. xliii.

[||] Tilloch's Phil. Mag. vol. xlii. p. 208. article of M. Saint-Hilaire.

[¶] Dictionaire, art. Oeuf.

I have observed already, that in many animals the skin performs the office of a muscle, though it is seldom that any thing like a fibrous structure can be traced in it. The skin of man offers a few partial instances of this power, as in the forehead and about the neck. In most quadrupeds we trace the power extending over the whole body, and enabling them to throw off at their option insects and other small animals that irritate them. The skin of the horse shudders through every point of it at the sound of a whip, and is said to be generally convulsed on the appearance of a lion or tiger. Birds, and especially the cockatoo and heron tribes, derive hence a power of moving at pleasure the feathers of the crest, neck, and tail; and the hedgehog, of rolling himself into a ball, and erecting his bristles by way of defence.

The colour of the skin is derived from the RETE MUCOSUM, OR MUCOUS WEB, which, as I have already remarked, is disposed between the true skin and the cuticle. The name of rete, or web, however, does not properly apply to this substance, for it has no vascularity, and is a mere butter-like material, which, when black, has a near resemblance in colour, as well as consistency, to the grease introduced between the nave of a wheel and its axletree. It is to this we owe the beautiful red or violet that tinges the nose and hind-quarters of some baboons, and the exquisite silver that whitens the belly of the dolphin and other cetaceous fishes. In the toes and tarsel membrane of ravens and turkeys it is frequently black; in hares and peacocks, gray; blue in the titmouse; green in the water-hen; yellow in the eagle; orange in the stork; and red in some species of scolopax or woodcock. It gives that intermixture of colours which besprinkles the skin of the frog and salamander; but it is for the gay and glittering scales of fishes, the splendid metallic shells of beetles, and the gaudy eye-spots that bedrop the wings of the butterfly, that nature reserves the utmost force of this wonderful pigment, and sports with it in her happiest caprices.

The different colours, and shades of colours, of the human skin, are attributable to the same material. Most of these, however, are intimately connected with a very full access of solar light and heat; for a deep sunburnt skin has a near approach to a mulatto.* And hence the darkness or blackness of the complexion has been generally supposed to proceed from the effect produced upon the mucous pigment by the solar rays, and especially those of the calorific kind, in consequence of their attracting and detaching the oxygene of the pigment in proportion to the abundance with which it impinges against the animal surface, and, in the same proportion, setting at liberty the carbone, which is thus converted into a more or less perfect charcoal. As this, however, is a subject which I shall have occasion to revert to in a distinct study upon the varieties of the human race,* it is unnecessary to pursue it any farther at present.

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* Humboldt, Essai Polit. sur la Nouvelle Espagne, &c.

It is a most curious circumstance, that the children of negroes are uniformly born white, or nearly so; and that the black pigment which colours them is not fully secreted till several months after birth. It sometimes happens, though rarely, that from a morbid state of the secretory organs there is no pigment secreted at all, or a white pigment is secerned instead of a black; whence we have white negroes, or persons exhibiting all the common characters of the negro breed in the form of the head and features of the face, with the anomaly of a white skin. And it sometimes happens, though still more rarely, that from a similar kind of morbid action affecting the secretory organs, the black pigment is secreted in alternate or interrupted divisions; and in this case we have negro children with brindled, marbled, or spotted skins: an instance of which was brought to me by a gentleman about two years ago, who had purchased the child in America, and who, I believe, afterwards exhibited it in this metropolis as a public show.

The CUTICLE is the thinnest of the layers that form the general integument of the skin. It often, however, becomes thicker, and sometimes even horny, by use. Thus it is always thicker in the sole of the foot and palm of the hand; and horny in the hands of blacksmiths and dyers; and still more so in the soles of those who walk barefooted on burning sands. It is annually thrown off whole by many tribes of animals—as grasshoppers, serpents, and spiders—and as regularly renewed; and by some animals it is renewed still more frequently: it is shed not less than seven times by the caterpillar of the moth and butterfly before either becomes a chrysalis. There are a few plants that exfoliate their cuticle in the same manner, and as regularly renew it. The West India plane-tree throws it off annually.

From the cuticle shoots forth a variety of substances, which either protect or adorn it, the roots of which are not unfrequently imbedded in the true skin itself. Of the harder kind, and which serve chiefly as a defence, are the nails, scales, claws, and horns; of the softer and more ornamental kinds, are hair, wool, silk, and feathers.

HAIR is the most common production, for we meet with it not only in all mammals, but occasionally in birds, fishes, and insects, varying in consistency and fineness, from a down invisible to the naked eye, to a bristle strong enough to support, when a foot long, ten or twelve pounds weight without breaking.

WOOL is not essentially different in its chemical properties from hair, and it varies equally in the fineness and coarseness of its texture. It is generally supposed by the growers, that the fineness of its texture depends upon the nature of the soil; yet of the two finest sorts we are at present acquainted with, that of Spain and that of New South Wales, which last is an offset from the Cape of Good Hope, and has yielded specimens of broad-cloth, manufactured in this country, as soft and silky as that of unmixed Merino wool—that of Spain is grown on a pure limestone soil, covered with small leguminous plants instead of with grass; and that of New South Wales on a soil totally destitute of lime, and covered with a long, rich, succulent grass alone.

Food, however, or climate, or both, must be allowed, under certain circumstances, to possess a considerable degree of influence; for it is a curious fact, that the hair of the goat and rabbit tribes, and the wool of the sheep tribe, are equally converted into silk by a residence of these animals in that district of Asia Minor which is called Angora, though we do not know that a similar change is produced by a residence in any other region; while, on the contrary, the wool of sheep is transformed into hair on the coast of Guinea.

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* Series II. Lect. III.

The fine glossy SILK of the Angora goat is well known in this country, as being often employed for muffs and other articles of dress. How far these animals might be made to perpetuate this peculiar habit by a removal from Angora to other countries has never yet been tried. Upon the whole, the soil and climate of New Holland offer the fairest prospect of success to such an attempt; and under this impression I have for some time been engaged in an endeavour to export a few of each genus of these animals from Angora to Port Jackson.

Silk, however, is chiefly secreted by insects, as some species of spider, whose threads, like the hair of the Angora goat, assume a silky gloss and lubricity, and the phalæna *mori*, or silk-worm, which yields it in great abundance. Yet there are a few shell-fishes which generate the same, and especially the genus pinna, or nacre, in all its species; whence Reaumur calls this kind the sea silk-worm. It is produced in the form of an ornamental byssus or beard; the animal is found gregariously in the Mediterranean and Indian seas; and the weavers of Palermo manufacture its soft threads into glossy stuffs or other silky textures. And I may here observe, that there are various trees that possess a like material in the fibres of their bark, as the morus *papyrifera*, and several other species of the mulberry; in consequence of which it has been doubted by some naturalists whether the silk-worm actually generates its cocoon, or merely eliminates it from the supply received as its food; but as the silk-worm forms it from whatever plants it feeds on, it is obviously an original secretion.

From the integument of the skin originates also that beautiful PLUMAGE which peculiarly characterizes the class of birds, and the colours of which are probably a result of the same delicate pigment that produces, as we have already remarked, the varying colours of the skin itself; though, from the minuteness with which it is employed, the hand of chemistry has not been able to separate it from the exquisitely fine membrane in which it is involved. But it is impossible to follow up this ornamental attire through all its wonderful features of graceful curve and irridescent colouring,—of downy delicacy and majestic strength,—from the tiny rainbow that plays on the neck of the humming-bird, to the beds of azure, emerald, and hyacinth, that tesselate the wings of the parrot tribe, or the ever-shifting eyes that dazzle in the tail of the peacock;—from the splendour and taper elegance of the feathers of the bird of paradise, to the giant quills of the crested eagle or the condur—that crested eagle, which in size is as large as a sheep, and is said to be able to cleave a man's skull at a stroke; and that condur which, extending its enormous wings to a range of sixteen feet in length, has been known to fly off with children of ten or twelve years of age.

Why have not these monsters of the sky been appropriated to the use of man? How comes it that he who has subdued the ocean and cultivated the earth; who has harnessed elephants, and even lions, to his chariot wheels; should never have availed himself of the wings of the eagle, the vulture, or the frigate pelecan? That, having conquered the difficulty of ascending into the atmosphere, and ascertained the possibility of travelling at the rate of eighty miles an hour through its void regions; he should yet allow himself to be the mere sport of the whirlwind, and not tame to his use, and harness to his car, the winged strength of these aërial racers, and thus stamp with reality some of the boldest fictions of the heathen poets? The hint has indeed long been thrown out; and the perfection to which the art of falconry was carried in former times, sufficiently secures it against the charge of absurdity or extravagance.

LECTURE XII.

ON THE DIGESTIVE FUNCTION AND THE ORGANS CONTRIBUTORY TO IT; THE DIFFERENT KINDS OF FOOD EMPLOYED BY DIFFERENT ANIMALS; CONTINUANCE OF LIFE THROUGH LONG PERIODS OF FASTING.

UNDER every visible form and modification matter is perpetually changing:—not necessarily so, or from its intrinsic nature; for the best schools of ancient times concur with the best schools of modern times, in holding its elementary principles, as I have already observed, to be solid and unchangeable; and we have still further seen, that, even in some of its compound, but gaseous, etherealized, and invisible forms, it is probably alike exempted from the law of change; while the Christian looks forward with holy hope to a period when this exemption will be general, and extend to every part and to every compound; to a period in which there will be new heavens and a new earth, and what is now corruptible will put on incorruption.

At present, however, we can only contemplate matter, under every visible form and modification, as perpetually changing; as living, dying, and reviving; decomposing into its primordial elements, and recombining into new forms, and energies, and modes of existence. The germ becomes a seed, the seed a sapling, the sapling a tree: the embryo becomes an infant, the infant a youth, the youth a man; and having thus ascended the scale of maturity, both instantly begin the downward path to decay; and, so far as relates to the visible materials of which they consist, both at length moulder into one common elementary mass, and furnish fresh fuel for fresh generations of animal or vegetable existence. So that all is in motion, all is striving to burst the bonds of its present state; not an atom is idle; and the frugal economy of nature makes one set of materials answer the purpose of many, and moulds it into every diversified figure of being, and beauty, and happiness.

But till the allotted time of existence has arrived, animals and vegetables are rendered equally capable of counteracting the waste they are perpetually sustaining in their individual frames: and are wisely and benevolently endowed with organs, whose immediate function it is to prepare a supply of reformative and vital matter adequate to the general demand.

Of this class of organs in plants we took a brief survey in our eighth lecture; and shall now proceed to notice the same class as it exists in animals, and which is generally distinguished by the name of the DIGESTIVE SYSTEM.

There is, perhaps, no animal function that displays a larger diversity of means by which it is performed than the present: and, perhaps, the only point in which all animals agree is in the possession of an internal canal or cavity of some kind or other in which the food is digested; an agreement which may be regarded as one of the leading features by which the animal structure is distinguished from the vegetable.

Let us then, in the first place, trace this cavity as it exists in man, and the more perfect animals; the organs which are supposed to be auxiliary to it, and the powers by which it accomplishes its important trust. Let us next observe the more curious deviations and substitutes that occur in classes that are differently formed: and lastly, let us attend to a few of the more singular anomalies that are occasionally met with, and especially in animals that are capable of subsisting on air or water alone, or of enduring very long abstinences or privations of food.

The alimentary cavity in man extends from the mouth through the whole range of the intestinal canal:* and hence its different parts are of very different diameters. In the mouth, where it commences, it is wider; it contracts in the esophagus or gullet; then again widens to form the stomach, and afterwards again contracts into the tube of the intestines. This tube itself is also of different diameters in different parts of its extent; and it is chiefly on its diversity of magnitude, that anatomists have established its divisions. Its general length is five or six times that of the man himself; and in children not less than ten or twelve times, in consequence of their diminutive stature. In some animals it is imperforate; it is so occasionally in birds, and fishes, and almost uniformly so in zoophytes.

Generally speaking, the extent of the digestive cavity bears a relation to the nature of the aliments by which the individual is designed to be nourished. The less analogous these aliments are to the substance of the animal they are to sustain, the longer they must remain in the body to undergo the changes that are necessary to assimilate them. Hence the intestinal tube of herbivorous animals is very long, and their stomach is extremely large, and often double or triple; while the carnivorous have a short and straight digestive canal, the food on which they feed being already of their own nature, and containing a larger quantity of nourishment in a less bulk; and hence demanding a smaller proportion both of time and space to become fit for use. In this respect man holds a medium between the two: his digestive canal is less complex than that of most animals that feed on grass alone, and more extensive than that of most animals that are confined to a diet of their own kind. Man is hence omnivorous, and is capable of subsisting on an aliment of either sort: and from his digestive organs, as well as from various others, is better qualified for every variety of soil and climate than any other animal.

Man, however, is by no means the only omnivorous animal in the world: for the great Author of nature is perpetually showing us that though he operates by general laws, he is in every instance the lord and not the slave of them. Hence, among quadrupeds, the swine, and among insects, the ant, possesses as omnivorous a power as man himself, and feeds equally on the fleshy parts of animals, and on grain, and the sweet juices of vegetables. In consequence of this omnivorous power in the ant, we may often make use of him as a skilful anatomist; for, by putting a dead frog, mouse, or other small animal in a box perforated with holes, and placing it near an ant-hill, we shall find it in a few days reduced to a perfect and exquisite skeleton, every atom of the soft parts being separated and devoured.

The solid materials of the food are first masticated and moistened in the mouth, excepting in a few cases, in which it is swallowed whole. It is then introduced into the stomach, and converted into an homogeneous pulp or paste, which is called chyme ; and shortly afterwards, by an additional process, into a fluid for the most part of a milky appearance, denominated chyle ; in which state it is absorbed or drunk up voraciously by thousands and tens of thousands of little mouths of very minute vessels, which are not often found in the stomach, but line the whole of the interior coating of that part of the intestinal tube into which the stomach immediately empties itself, and which are perpetually waiting to imbibe its liquid contents. These vessels constitute a distinct part of the lymphatic system; they are called lacteals from the usual milky appearance of the liquid they absorb and contain. They progressively anastomose or unite together, and at length terminate in one common trunk, named the thoracic duct, which conveys the different streams thus collected and aggregated to the sanguineous system, to be still farther operated upon, and elaborated by the action of the heart and the lungs.

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* Stud. of Med. ii. 2.

The means by which the food is broken down and rendered pultaceous after being received into the stomach are various and complicated. In the first place, the muscular tunic of the stomach acts upon it by a slight contraction of its fibres, and so far produces a mechanical resolution : secondly, the high temperature maintained in the stomach by the quantity of blood contained in the neighbouring viscera and sanguiferous vessels, gives it the benefit of accumulated heat, and so far produces a concoctive resolution ; and thirdly, the stomach itself secretes and pours forth from the mouths of its minute arteries a very powerful solvent, which is by far the chief agent in the process, and thus produces a chemical resolution. In this manner the moistened and manducated food becomes converted into the pasty mass we have already called chyme : and fourthly, there are a variety of juices separated from the mass of the blood by distinct glands, situated for this purpose in its vicinity, which are thrown into the duodenum, or that part of the canal into which the stomach immediately opens, by particular conduits, and in some way or other appear to contribute to the common result, and to transform the chyme into chyle, but concerning the immediate powers or modes of action of which we are in a considerable degree of darkness. Of these glands the most remarkable and the most general are the liver and the pancreas or sweet-bread ; the first of which secretes the bile, and is always of a considerable size, and appears to produce a very striking effect on the blood itself, by a removal of several of its principles, independently of its office as a digestive organ.

From this brief survey of the process of digestion it is obvious that the stomach itself performs by far the principal part ; in some animals indeed it appears to perform the whole ; and it is hence necessary that we examine the general structure and powers of this organ with a little more minuteness.

In man the stomach is situated on the left side of the midriff; in its figure it resembles the pouch of a bag-pipe ; its left end is most capacious ; its upper side is concave, its lower convex ; and the two orifices for receiving and discharging the food are both situated in the upper part. In its substance it consists of three distinct coats or layers, the external and internal of which are membranous, and the middle muscular. The internal coat, moreover, is lined with a villous or downy apparatus, and is extremely convoluted or wrinkled ; the wrinkles increasing in size as the diameter of the stomach contracts.

From what I have already observed it must appear that the process of digestion in man consists of three distinct acts: mastication, which is the office of the mouth, and by which the food is first broken down; chymification, or its reduction into pulp, which is the office of the stomach; and chylification, or its dilution into a fluid state, which is the office of that part of the intestinal canal which immediately communicates with the stomach. The whole of this process is completed in about three hours, and under certain states of the stomach, to which I shall advert presently, almost as quickly as the food is swallowed. The most important of these three actions is that of chymification; and, while it takes place, both orifices of the stomach are closed, and a degree of chilliness is often produced in the system generally, from the demand which the stomach makes upon it for an auxiliary supply of heat, without an augmentation of which it appears incapable of performing this important function.

Considering the comparatively slender texture of the chief digesting organ, and the toughness and the solidity of the substances it digests, it cannot appear surprising that mankind should have run into a variety of mistaken theories in accounting for its mode of action. Empedocles and Hippocrates supposed the food to be softened by a kind of putrefaction. Galen, whose doctrine descended to recent times, and was zealously supported by Grew and Santarelli, ascribed the effect to concoction, produced, like the ripening and softening of fruits beneath a summer sun, by the high temperature of the stomach from causes just pointed out. Pringle and Macbride advocated the doctrine of fermentation, thus uniting the two causes of heat and putrefaction assigned by the Greek writers; while Borelli, Keil, and Pitcairn resolved the entire process into mechanical action, or trituration; thus making the muscular coating of the stomach an enormous mill-stone, which Dr. Pitcairn was extravagant enough to conceive ground down the food with a pressure equal to a weight of not less than a hundred and seventeen thousand and eighty pounds, assisted at the same time, in its gigantic labour, by an equal pressure derived from the surrounding muscles.*

Each of these hypotheses, however, was encumbered with insuperable objections; and it is difficult to say which of them was most incompetent to explain the fact for which they were invented.

Boerhaave endeavoured to give them force by interunion, and hence combined the mechanical theory of pressure with the chemical theory of concoction; while Haller contended for the process of maceration. But still a something else was found wanting, and continued to be so till Cheselden in lucky hour threw out the hint, for at first it was nothing more than a hint, of a menstruum secreted into some part of the digestive system; a hint which was soon eagerly laid hold of, and successfully followed up by Haller, Reaumur, Spallanzani, and other celebrated physiologists. And though Cheselden was mistaken in the peculiar fluid to which he ascribed the solvent energy, namely the saliva, still he led forward to the important fact, and the GASTRIC JUICE was soon afterwards clearly detected, and its power incontrovertibly established.

This wonderful menstruum, the most active we are acquainted with in nature, is secreted by a distinct set of vessels, that exist in the texture of the stomach, and empty themselves into its cavity by innumerable orifices invisible to the naked eye; and it is hence called gastric juice, from γαστηρ, which is the Greek for stomach. Mr. Cruickshank supposes about a pound of it to be poured forth every twenty-four hours. "The drink," says he, "taken into the stomach may be two pounds in twenty-four hours; the saliva swallowed may be one pound in the same period, the gastric juice another, the pancreatic juice another. The bile poured into the intestines Haller supposes about twenty ounces, besides the fluid secreted through the whole of the internal surfaces of the intestines;"* which Haller calculates at not less than eight pounds in twenty-four hours,—a calculation nevertheless that Blumenbach regards as extravagant.†

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* See Ser. I. Lect. x.

The quantity of the gastric juice, however, seems to vary very considerably, according to the demand of the system generally, or the state of the stomach itself. In carnivorous birds, whose stomachs are membranous alone, and consequently whose food is chymified by the sole action of the gastric juice, without any collateral assistance or previous mastication, this fluid is secreted in much larger abundance; as it is also in those who labour under that morbid state of the stomach which is called canine appetite; or when, on recovery from fevers, or in consequence of long abstinence, the system is reduced to a state of great exhaustion, and a keen sense of hunger induces a desire to devour food voraciously and almost perpetually.

Such was the situation of Admiral Byron and his two friends Captains Cheap and Hamilton, after they had been shipwrecked on the western coast of South America, and had been emaciated, as he tells us, to skin and bone, by having suffered with hunger and fatigue for some months. "The governor," says Admiral Byron, "ordered a table to be spread for us with cold ham and fowls, which only we three sat down to, and in a short time despatched more than ten men with common appetites would have done. It is amazing that our eating to that excess we had done from the time we first got among these kind Indians had not killed us; we were never satisfied, and used to take all opportunities, for some months after, of filling our pockets when we were not seen, that we might get up two or three times in the night to cram ourselves."‡

When pure and in a healthy state, the gastric juice is a thin, transparent, and uninflammable fluid, of a weak saline taste, and destitute of smell. Generally speaking it is neither acid nor alkaline; but it appears to vary more or less in these properties, not only in animals whose organs of digestion are of a different structure, but even in the very same animal under different circumstances. It may, however, be laid down as an established rule, that in *carnivorous* and *graminivorous* animals possessing only a single stomach, this fluid is acid, and colours blue vegetable juices red; in *omnivorous* animals, as man, whose food is composed both of vegetable and animal diet, it is neutral; and in graminivorous *ruminating* animals with four stomachs, and particularly in the adults of these tribes, it has an alkaline tendency, and colours blue vegetable juices green.

There are two grand characteristics by which this fluid is pre-eminently distinguished; a most astonishing faculty of counteracting and even correcting putrefaction; and a faculty, equally astonishing, of dissolving the toughest and most rigid substances in nature.

Of its ANTISEPTIC POWER abundant proofs may be adduced from every class of animals. Among mankind, and especially in civilized life, the food is usually eaten in a state of sweetness and freshness; but fashion, and the luxurious desire of having it softened and mellowed to our hands, tempt us to keep several kinds as long as we can endure the smell. The wandering hordes of gipsies, however, and the inhabitants of various savage countries, and especially those about the mouth of the Orange river in Africa, carry this sort of luxury to a much higher pitch, for they have no objection to an offensive smell, and appear to value their food in proportion to its approach towards putrefaction. Now all those foods, whatever be the degree of their putridity, are equally restored to a state of sweetness by the action of this juice, a short time after they have been introduced into the stomach.

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* Anat. of the Absorbing Vessels, p. 106.

† Physiol. Institut. xxvii. § 410.

‡ Voyage, p. 181. See also Hunter's Animal Economy, p. 196.

Dr. Fordyce made a variety of experiments in reference to this subject upon the dog, and found uniformly that the most putrid meat he could be made to swallow, was in a very short time deprived of its putrescency. We cannot therefore be surprised that crows, vultures, and hyenas, who find a pleasure in tainted flesh, should fatten upon so impure a diet; nor that the dunghill should have its courtiers among insects as well as the flower-garden.

The gastric juice has hence been employed as an antiseptic in a variety of cases out of the body.

Spalanzani has ascertained that the gastric juice of the crow and the dog will preserve veal and mutton perfectly sweet, and without consumption, thirty-seven days in winter; while the same meats immersed in water emit a fetid smell as early as the seventh day, and by the thirtieth are resolved into a state of most offensive liquidity.

Physicians and surgeons have equally availed themselves of this corrective quality, and have occasionally employed the gastric juice, internally in cases of indigestion from a debilitated stomach, and externally as a check to gangrenes, and a stimulus to impotent and indolent ulcers. I do not know that this practice has hitherto taken place very largely in our own country, but it has been extensively resorted to on the continent, and especially in Switzerland and Italy; and in many cases with great success.

But the gastric juice is as remarkable for its solvent, as for its antiputrescent property. Of this any industrious observer may satisfy himself by attending to the process of digestion in many of our most common animals; but it has been most strikingly exemplified in the experiments of Reaumur and Spalanzani. Pieces of the toughest meats, and of the most solid bones, enclosed in small perforated tin-cases to guard against all muscular action, have been repeatedly thrust into the stomach of a buzzard: the meats were uniformly found diminished to three-fourths of their bulk in the space of twenty-four hours, and reduced to slender threads; and the bones were wholly digested, either upon the first trial or a few repetitions of it. Dr. Stevens repeated the experiment on the human stomach by means of a perforated ivory ball, which he hired a person at Edinburgh alternately to swallow and disgorge, when a like effect was observed.

The gastric juice of the dog dissolves ivory itself and the enamel of the teeth; that of the hen has dissolved an onyx and diminished a louis d'or;* even among insects we find some tribes that fatten upon the fibrous parts of the roots of trees, and others upon metallic oxydes. And it is not long since, that, upon examining the stomach and intestinal tube of a man who died in one of the public hospitals of this metropolis, and who had some years before swallowed a number of clasp-knives out of hardihood, their handles were found digested, and their blades blunted, though he had not been able to discharge them from his body.

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* Swammerdam, Biblia Naturea, p. 168.

It is in consequence of this wonderful power that the stomach is sometimes found in the extraordinary condition of digesting itself; and of exhibiting, when examined on dissection, various erosions in different parts of it, and especially towards the upper half, into which the gastric juice is supposed to flow most freely. It is the opinion of Mr. John Hunter,* however, whose opinions are always entitled to respect, that such a fact can never take place except in cases of sudden death, when the stomach is in full health, and the gastric juice, now just poured forth, is surrounded by a dead organ. For he plausibly argues, that the moment the stomach begins to be diseased, it ceases to secrete this fluid, at least in a state of perfect activity; and that so long as it is itself alive, it is capable by its living principle of counteracting the effect of this solvent power. Yet a case has lately been published by Mr. Burns of Glasgow, in which the stomach appears to have been eroded, although the death, instead of being sudden, did not take place till after a long illness and great emaciation of the body. It is possible, however, that even here the stomach did not participate in the disease. That the living principle of the stomach is capable, so long as it continues in the stomach, of resisting the action of the gastric juice, can hardly be questioned. And it is to the superior power of this principle of life, that worms and the ova of insects are so often capable of existing in the stomach uninjured, and even of thriving in the midst of so destructible an agency.

But though the solvent juice of the stomach is the chief agent in the process of digestion, its muscular power contributes always something, and in many animals a considerable proportion, towards the general result; and hence, the shape and structure of this organ, instead of being uniformly alike, is varied with the most skilful attention to the nature of the mechanism by which it is to operate.

In its general construction the stomach of different animals may be divided into three kinds; membranous, muscular, and bony. The first is common to graminivorous quadrupeds, and to carnivorous animals of most kinds; to sheep, oxen, horses, dogs, and cats; eagles, falcons, snakes, frogs, newts, and the greater number of fishes, as well as to man himself. The second is common to graminivorous birds; and to granivorous animals of most kinds: to fowls, ducks, turkeys, geese, and pigeons. The third, to a few apterous insects, a few soft-bodied worms, and a few zoophytes: to the cancer-genus, the cuttle-fish, the sea hedgehog; tubipores and madrepores.

Of the membranous stomach we have already taken notice in describing that of man; and at the bony stomach we took a glance in a late lecture on the teeth and other masticatory organs. It only remains, therefore, that we make a few remarks on that singular variety of the membranous stomach which belongs to ruminant animals, and on the muscular stomach of granivorous and graminivorous birds.

All animals which ruminate must have more stomachs or ventricles than one; some have two, some three; and the sheep and ox not less than four. The food is carried down directly into the first, which lies upon the left side, and is the largest of all; the vulgar name for this is the *paunch*. There are no wrinkles on its internal surface; but the food is considerably macerated in it by the force of its muscular coat, and the digestive secretions which are poured into it. Yet, in consequence of the vegetable and unanalogous nature of the food, it requires a much farther comminution; and is hence forced up by the esophagus into the mouth, and a second time masticated; and this constitutes the act called rumination, or chewing the cud. After this process, it is sent down into the second ventricle, for the esophagus opens equally into both, and the animal has a power of directing it to which soever it pleases. The ventricle is called the *bonnet* or *king's-hood;* its internal surface contains a number of cells, and resembles a honey-comb; it macerates the food still farther; which is then protruded into the third ventricle, that on account of its very numerous folds or wrinkles, is called *many-plies*, and vulgarly *many-plus*. It is here still farther elaborated, and is then sent into the fourth ventricle, which, on account of its colour, is called *the red*, and by the French *le caillé*, or the curdle, since it is here that the milk sucked by calves first assumes a curdled appearance. It is thus that the process of digestion is completed, and it is this compartment that constitutes the true stomach, to which the others are only vestibules.

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* Phil. Trans. 1772.

There are some animals, however, which do not ruminate, that have more than one stomach; thus the hampster has two, the kangaroo three, and the sloth not less than four.* Nor does the conformation terminate even with quadrupeds; for among birds the ostrich has two ventricles,† and among fishes the stomateus *Hiatola*. The horse and ass, on the contrary, though graminivorous quadrupeds like the ox, have only one stomach.

There may seem, perhaps, something playful in this application of different systems of mechanism to the same class of animals, and of the same system to different classes: but it shows us, at least, that the hand of nature is not necessarily fettered by its own general laws, nor compelled, even under the same circumstances, to adopt the same cause to produce the same effect. Yet, if we had time, we might proceed beyond this remark, and point out, if I mistake not, the reasons for such diversities, and the skill with which they are introduced. Thus the horse and ass are formed for activity, and require lightness: and hence the bulk and complexity of three or four stomachs would counteract the object for which they are created; but it does not interfere with the pursuits of the ox, which is heavy and indolent in its nature; and which, though it may perhaps be employed as a beast of burden, can never be made use of for speed. The activity of the horse and ass, moreover, excites, from the stimulus it produces, a larger secretion of gastric juice than is met with in the ox, and thus in a considerable degree supplies a substitute for the three deficient stomachs; but it by no means extracts the nutriment so entirely from the food introduced into it; and we hence see the reason why the dung of horses is richer than that of black cattle, and why they require three or four times as much provender.

We may apply the whole of these remarks to the ostrich, whose peculiar habitation is the sandy and burning deserts of the torrid zone, where not a blade of grass is to be seen for hundreds of miles, and where the little food it lights upon must be made the most of. The double stomach it possesses enables it to accomplish this purpose, and to digest coarse grass, prickly shrubs, and scattered pieces of leather, with equal ease. This animal is supposed to be one of the most stupid in nature, and to have no discernment in the choice of its food; for it swallows stone, glass, iron, and whatever else comes in its way, along with its proper sustenance. But it is easy to redeem the ostrich from such a reproach, at least in the instance before us: for these very articles, by their hard and indestructible property, perform the office of teeth in the animal's stomach; they enable it to triturate its food most minutely, and to extract its last particle of nutriment. It is true that in the class of birds, or that to which the ostrich belongs, a double stomach must necessarily, to a certain extent, oppose the general levity by which this class is usually characterized. But the wings of the ostrich are not designed for flight: they assist him in that rapidity of running for which he is so celebrated, and in which he exceeds all other animals, but are not designed to lift him from the earth. In reality, the ostrich appears to be the connecting link between birds and quadrupeds, and especially ruminant quadrupeds. In its general portrait, as well as in the structure of its stomach, it has a near resemblance to the camel; in its voice, instead of a whistle, it has a grunt, like that of the hog: in its disposition, it is as easily tamed as the horse, and like him may be employed, and often has been, as a racer, though in speed it outstrips the swiftest racehorse in the world. Adanson asserts, indeed, that it will do so when made to carry double; and that, when at the factory of Podore, he had two ostriches carefully broken in, the strongest of which, though young, would run swifter, with two negroes on his back, than a racer of the best breed.

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* Wiedemann, Archiv. b. i.

† Valisnieri, Anatomia, &c. p. 159. 1713.

Yet widely different is the mechanism of the stomach in birds of flight that feed on vegetables: nor could any contrivance be better adapted to unite the two characters of strength and levity. Instead of the bulky and complicated compartments of the membranous stomach of ruminant animals, we here meet with a thick, tough, muscular texture, small in size, but more powerful than the stoutest jaw-bone, and which is usually called GIZZARD.

It consists of four distinct muscles, a large hemispherical pair at the sides, and two smaller muscles at the two ends of the cavity. These muscles are distinguished from the rest belonging to the animal, not less by their colour than by their prodigious strength; and the internal cuticle with which they are covered is peculiarly callous, and often becomes quite horny from pressure and friction.

The gizzard of grazing birds, as the goose and turkey, differs in some degree in the formation of its muscles from that of granivorous. They have also " a swell in the lower part of the esophagus, which answers the purpose of a reservoir, in which the grass is retained, macerated, and mixed with the secretions poured out by the glandular surfaces surrounding it, in this respect corresponding to the first and second stomachs of ruminating animals, in which the grass is prepared for mastication,"* though essentially lighter.

In most birds, indeed, we meet with an approach towards this, in a cavity situated above the muscular stomach, and called the crop or craw. This first receives the food from the mouth, and slightly softens it by a mucous fluid secreted from its interior; and thus prepared, a part of it is given back to the young, where there are young to partake of it, and the rest is sent to the gizzard or proper stomach, whose muscular mechanism, in conjunction with its gastric juice, soon comminutes it into the most impalpable pulp. There are several kinds, however, that, like the ostrich, endeavour to assist the muscular action by swallowing pebbles or gravel; some of which find this additional aid so indispensable, that they are not able to digest their food, and grow lean, without it. Spalanzani attempted to prove that these stones are of no use, and are only swallowed by accident; but their real advantage has been completely established by Mr. J. Hunter, who has correctly observed, that the larger the gizzards, the larger are the pebbles found in them. In the gizzard of a turkey he counted two hundred; in that of a goose, a thousand.

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* Home, On the Gizzards of Grazing Birds, Phil. Trans. 1810, p. 183.

Reaumur and Spalanzani have put the prodigious power of this muscular stomach to the test, by compelling geese and other birds to swallow needles, lancets, and other hard and pointed substances; which, in every experiment, were found, a few hours afterwards, on killing and examining the animal, or on its regorging them, to be broken off and blunted, without any injury to the stomach whatever.

Yet, as all animals are not designed for all kinds of food, neither the force of the strongest muscular fibres, nor the solvent power of the most active gastric juice, will avail in every instance. The wild-boar and the vulture devour the rattlesnake uninjured, and fatten upon it; but there are many kinds of vegetables which neither of these are capable of digesting. The owl digests flesh and bone, but cannot be made to digest grain or bread; and in one instance died, under the experiments of Spalanzani, when confined to vegetable food. The falcon seems as little capable of dissolving vegetables; yet the eagle dissolves bread and bone equally; and wood-pigeons may, in like manner, be brought to live, and even to thrive, on flesh-meat. The procellaria *pelagica*, or stormy petril, lives entirely on oil, as the fat of dead whales and other fishes, whenever he can get it: and if not, converts every thing he swallows into oil. He discharges pure oil from his mouth at objects that offend him; and feeds his young with the same substance. This is the most daring of all birds in a tempest, though not more than six inches long. As soon as the clouds begin to collect, he quits his rocky covert, and enjoys the gathering and magnificent scenery; he rides triumphantly on the whirlwind, and skims with incredible velocity the giddiest peaks, and deepest hollows of the most tremendous waves. His appearance is a sure presage of foul weather to the seaman.

There are some tribes of animals that appear capable of subsisting on water alone, and a few on mere air, incapable as these substances seem to be, at first sight, of affording any thing like solid nutriment. Leeches and tadpoles present us with familiar proofs of the former assertion, and there are various kinds of fishes that may be added to the catalogue. Rondelet kept a silver fish in pure water alone for three years; and at the end of that period it had grown as large as the glass globe that contained it. Several species of the carp kind, and especially the gold-fish, have a similar power; and even the pike, the most glutinous, perhaps, of the whole class, will both live and thrive upon water alone in a marble basin.

The bee, and various other insects, derive their nutriment from the nectar and effluvium of flowers. So also does the trochilus genus, or humming-bird, which appears to be the connecting link between the two classes; buzzing like the bee itself with a joyous hum around the blossom on which it lights; and in one of its species, t. *minimus*, not exceeding it in size, and only weighing from 20 to 45 grains.

Air alone appears sufficient for the support of animals of other kinds. Snails and chameleons have been known repeatedly to live upon nothing else for years.[*] Garman asserts that it is a sufficient food for spiders; and that though they will devour other food, as fishes will that may be maintained alone on water, they do not stand in need of any other. Latreille confirms this assertion to a considerable extent, by informing us that he stuck a spider to a piece of cork, and precluded it from communication with any thing else for four successive months, at the end of which time it appeared to be as lively as ever.[†] And Mr. Baker tells us, in the Philosophical Transactions, that he had a beetle that lived in a glass confinement for three years without food, and then fled away by accident.

The larves of ants, as well as of several other insects of prey, are not only supported by air, but actually increase in bulk, and undergo their metamorphoses without any other nourishment. It is probable, also, that air is at times the only food of the scolopendra *phosphorea*, or luminous centipede, which has been seen illuminating the atmosphere, and sometimes falling into a ship, a thousand miles from land.

Amphibious animals have a peculiar tenacity to life under every circumstance of privation; and not only frogs, and toads, but tortoises, lizards, and serpents, are well known to have existed for months, and even years, without other food than water—in some instances, without other food than air.

Mr. Bruce kept two cerastes, or horned snakes, in a glass jar for two years, without giving them any thing. He did not observe that they slept in the winter-season; and they cast their skins, as usual, on the last day of April.[‡]

Lizards, and especially the newt species, have been found imbedded in a chalk-rock, apparently dead and fossilized, but have re-assumed living action on exposure to the atmosphere.[§] On their detection in this state the mouth is usually closed with a glutinous substance, and closed so tenaciously, that they often die of suffocation in the very effort to extricate themselves from this material.[‖]

In respect to toads the same fact has been ascertained, for nearly two years, by way of experiment;[¶] and has been verified, by accident, for a much longer term of time. The late Edward Walker, Esq. of Guestingthorpe, Essex, informed me not long since, that he had found a toad perfectly alive in the midst of a full grown elm, after it was cut down by his order, exactly occupying the cavity which it appeared gradually to have scooped out as it grew in size, and which had not the smallest external communication by any aperture that could be traced. And very explicit, and apparently very cautious, accounts have been repeatedly published in different journals, of their having been found alive, imbedded in the very middle of trunks of trees and blocks of marble, so large and massy, that, if the accounts be true, they must have been in such situations for at least a century.[**] There is a very particular case of this kind given by M. Seigue, in the Memoirs of the Royal Academy of Paris.[††]

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[*] Encyclop. Brit. art. Physiol. p. 679.

[†] Monthly Rev. Appx. lv. 494.

[‡] Voyages, Appendix, p. 296. 8vo. edit.

[§] Wilkinson, Tilloch's Phil. Mag. Dec. 1816.

[‖] Journ. of Science, No. XII. p. 375.

[¶] See Dalyell's Introd. to his Translation of Spalanzani's Tracts, p. xliii. 1803.

[**] See various instances, Encycl. Brit. art. Physiol. p. 681.

[††] Mem. 1731. H. 24. Dr. Edwards, of Paris, has sufficiently ascertained of late, that blocks of mortar, and heaps of sand, are porous enough to admit so much air as is requisite to support the life of lizards, toads, and other amphibials of the batrachian family; but that they all perish if surrounded by mercury, or even water, so as to intercept the air by their being encompassed by an exhausted receiver. In boxes of mortar or sand, however, they live much longer than in boxes plunged under water. The probable cause is, that the air of the atmos-

These observations lead us to another anomaly of a more extraordinary nature still; and that is, the power which man himself possesses of existing without food, under certain circumstances, for a very long period of time. This is often found to take place in cases of madness, especially that of the melancholy kind, in which the patient resolutely refuses either to eat or drink for many weeks together, with little apparent loss either of bulk or strength.

There is a singular history of Cicely de Ridgeway, preserved among the Records in the Tower of London, which states, that in the reign of Edward III., having been condemned for the murder of her husband, she remained for forty days without either food or drink. This was ascribed to a miracle, and the king condescended in consequence to grant a pardon.

The Cambridgeshire farmer's wife, who, about twenty years ago, was buried under a snow-storm, continued ten or twelve days without tasting any thing but a little of the snow which covered her. But in various other cases we have proofs of abstinence from food having been carried much farther, and without serious evil. In the Edinburgh Medical Essays for 1720, Dr. Eccles makes mention of a beautiful young lady, "about sixteen years of age," who, in consequence of the sudden death of an indulgent father, was thrown into a state of tetanus, or rigidity of all the muscles of the body, and especially those of deglutition, so violent as to render her incapable of swallowing for two long and distinct periods of time; in the first instance for thirty-four, and in the second, which occurred shortly afterwards, for fifty four-days: during "all which time, her first and second fastings, she declared," says Dr. Eccles, "she had no sense of hunger or thirst; and when they were over, she had not lost much of her flesh."

In our own day, we have had nearly as striking an instance of this extraordinary fact, in the case of Anne Moore, of Tutbury in Staffordshire, who, in consequence of a great and increasing difficulty in swallowing, at first limited herself to a very small daily portion of bread alone, and on March 17, 1807, relinquished even this, allowing herself only occasionally a little tea or water, and in the ensuing September pretended to abstain altogether from liquids as well as solids. From the account of Mr. Granger,* a medical practitioner of reputation, who saw her about two years afterwards, she appears to have suffered very considerably, either from her abstinence, or from that general morbid habit which induced her to use abstinence. He says, indeed, that her mental faculties were entire, her voice moderately strong, and that she could join in conversation without undergoing any apparent fatigue: but he says, also, that her pulse was feeble and slow; that she was altogether confined to her bed; that her limbs were extremely emaciated; that convulsions attacked her on so

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phere pervades the pores of the sand or margin pretty freely; but that it is not extricated from the circumfluent water so as to pervade the poles of the box buried in it. This however is not the explanation offered by Dr. Edwards. He found also that frogs will live a longer or shorter period of time under water, according to the temperature of the water, and the previous temperature of the surrounding atmosphere. They die speedily if the water be lower than 32° Fahr. or higher than 108°: that the longest duration of life is at 32°, at which point life will continue for several hours; that its duration diminishes with the elevation of the scale above this point, and that it is extinguished in a few minutes at 108°.

The most favourable point in the temperature of the atmosphere is also 32°. If the season have maintained this point for some days antecedently to the frog's being plunged under water, itself of 32°, the animal will live from 24 to 60 hours. De l'Influence des Agens Physiques sur la Vie; also, Memoires sur l'Asphyxie, &c. 1817. Paris, 8vo. 1824.

* Edinburgh Med. and Surg. Journal. No. xix. July 1809. p. 319.

slight an excitement as surprise, and that she had then very lately lost the use of her lower limbs.

It afterwards appeared, that in this account of herself she was guilty of some degree of imposition, in order to attract visiters, and obtain pecuniary grants. Dr. Henderson, another medical practitioner, of deserved repute in the neighbourhood, had suspected this, and published his suspicions :* and an intelligent committee was at length arranged, and assented to by the woman herself, for the purpose of watching her by day and by night. Cut off hereby altogether from fluids, which she had of late pretended to relinquish, as well as from solids, she was hardly able to reach the tenth day, and still less to confess, as she then did, that she had occasionally been supplied by her daughter with water and tea. "On the whole," the committee conclude, in their account of her, "though this woman is a base impostor with respect to her pretence of *total* abstinence from all food whatever, liquid or solid, yet she can perhaps endure the privation of solid food longer than any other person. It is thought by those best acquainted with her, that she existed on a mere trifle, and that from hence came the temptation to say that she did not take any thing. If, therefore, any of her friends could have conveyed a bottle of water to her, unseen by the watch, and she could occasionally have drunk out of it, little doubt is entertained that she would have gone through the month's trial with credit. The daughter says that her mother's principal food is tea, and there is reason to believe this to be true."† But this opinion leaves the case almost as extraordinary as before the detection of the fraud; for if true, and it is greatly borne out by the fact to which it appeals, this woman was capable of subsisting on what is ordinarily regarded as no nutriment whatever, and required nothing more for her support than an occasional draught of pure water.

Hildanus, Haller, and other physiologists, have collected various instances of a similar kind : many of them of a much longer duration of abstinence ; some of them, indeed, extending to not less than sixteen years ; but in general too loosely written and attested to be entitled to full reliance. Yet the Philosophical Transactions in their different volumes contain numerous cases of the same kind, apparently drawn up with the most scrupulous caution, and supported by the best kind of concurrent evidence. In one of the earlier volumes‡ we meet with an account of four men who were compelled to subsist upon water alone for twenty-four days, in consequence of their having been buried in a deep excavation by the fall of a superincumbent stratum of earth under which they were working, and it being this length of time before they were extricated. The water which they drank of, was from a spring at hand ; and they drank of it freely, but tasted nothing else.

A still more extraordinary account is recorded in the same journal for the year 1742, and consists of the history of a young man, who at the age of sixteen or seventeen from having drunk very freely of cold water when in a violent perspiration, was thrown into an inflammatory fever, from which he escaped with difficulty, and with such a dislike to foods of all kinds, that for *eighteen years*, at the time this account was drawn up, he had never tasted any thing but water. The fact was well known throughout the neighbourhood; but an imposition having been suspected by several persons who saw him, he had been shut up at times in close confinement for twenty days at a trial, with the most scrupulous care that he should communicate with nothing but water. He uniformly enjoyed good health, and appears to have had ejections, but seldom.

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* An examination of the imposture of Anne Moore, called the fasting woman of Tutbury, &c. By Alexander Henderson, M.D. 8vo. 1813.

† A full exposure of Anne Moore, the pretended fasting woman of Tutbury, 8vo. 1813. The newspapers have informed us that this poor woman died at Macclesfield about the beginning of October 1825, at the advanced age of 76.

‡ Phil. Trans. 1684.

A multitude of hypotheses have been offered to account for these wonderful anomalies, but none of them do it satisfactorily; and I should be unworthy of the confidence you repose in me, if I did not ingenuously confess my utter ignorance upon the subject. Water in most cases appears to have been absolutely necessary, yet not in all; for Hildanus, who, though somewhat imaginative, appears to have been an honest and an able man in the main, assures us, that Eva Flegen, who had fasted for sixteen years when he saw her in 1612, had abstained entirely from liquids as well as solids: and in the case of impacted toads, especially those found in blocks of closely crystallized marble, the moisture they receive must often be very insignificant.

Perhaps one of the most singular cases, and at the same time one of the best authenticated on record, is that of Janet M'Leod, published in the Philosophical Transactions by Dr. Mackenzie.* She was at this time thirty-three years of age, unmarried, and from the age of fifteen had had various paroxysms of epilepsy, which had considerably shaken her frame, rendered the elevator muscles of the eyelids paralytic, so that she could only see by lifting the lids up, and produced so rigid a locked jaw that her mouth could rarely be forced open by any contrivance. She had lost very nearly her power of speech and deglutition, and, with this, all desire either to eat or drink. Her lower limbs were retracted towards her body; she was entirely confined to her bed, slept much, and had seldom any other egestions than periodical discharges of blood, apparently from the lungs, which was chiefly thrown out by the nostrils. During a very few intervals of relaxation she was prevailed upon with great difficulty to put a few crumbs of bread, comminuted in the hand, into her mouth, together with a little water sucked from her own hand, and in one or two instances a little gruel; but even at these attempts almost the whole was ejected. On two occasions also, after a total abstinence of many months, she made signs of wishing to drink some water, which was immediately procured for her. On the first occasion, the whole seemed to be returned from her mouth; but she was greatly refreshed by having it rubbed upon her throat. On the second occasion, she drank off a pint at once, but could not be either prevailed upon or forced to drink any more, notwithstanding that her father had now fixed a wedge between her teeth, two of which were hereby broken out. With these exceptions, however, she seems to have passed upwards of four years without either liquids or solids of any kind, or even an appearance of swallowing. She lay for the most part like a log of wood, with a pulse scarcely perceptible from feebleness, but distinct and regular: her countenance was clear and pretty fresh; her features neither disfigured nor sunk; her bosom round and prominent, and her limbs not emaciated. Dr. Mackenzie watched her with occasional visits, for eight or nine years, at the close of which period she seems to have been a little improved. His narrative is very precisely as well as minutely detailed.

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* Vol. lxvii. year 1777.

and previously to its being sent to the Royal Society was read over before the patient's parents, who were known to be persons of great honesty, as also before the elder of the parish, who appears to have been an excellent man ; and, when sent, was accompanied by a certificate as to the general truth of the facts, signed by the minister of the parish, the sheriff-depute, and six other individuals of the neighbourhood, of high character, and most of them justices of the peace.

Yet even with the freest use of water, what can we make of such cases upon any chain of chemical facts at present discovered ? what can we make of it even in conjunction with the use of air ? The weight and solid contents of the animal body is derived chiefly from that principle which modern chemists denominate carbone ; yet neither water nor air, when in a state of purity, contains a particle of carbone. Again the substance of the animal frame is distinguished from that of the vegetable by its being saturated with nitrogene, of which plants possess comparatively but very little ; yet though the basis of atmospherical air consists of nitrogene, water has no more of this principle than it has of carbone ; nor is it hitherto by any means established, that even the nitrogene of the animal system is in any instance derived from the air, or introduced by the process of respiration : for the experiments upon this subject, so far as they go, are in a state of opposition, and keep the question on a balance—*factis contraria facta.*

Shall we then suppose with others, that the circle of perpetual mutation, which is imposed upon every other species of visible matter, is in these cases suspended, and that the different organs of the system are, so long as the anomaly continues, rendered incorruptible. But this is to suppose the intervention of a miracle, and without an adequate cause. Let us then rather confess our ignorance than attempt to be wise upon the basis of conceit. All that we do know is, that bodies of every kind are reducible to a few elementary principles, which appear to be unchangeable, and are certainly invisible ; and that from different combinations and modifications of these proceeds every concrete and visible form : hence air itself, and water : hence mineral, vegetable, and animal substances. Air, therefore, and water, or either separately, may contain the rudimental materials of all the rest. We behold metallic stones, and of large magnitude, fall from the air, and we suppose them to be formed there : we behold plants suspended in the atmosphere, and still, year after year, thriving and blooming, and diffusing odours : we behold insects apparently sustained from the same source ; and worms, fishes, and occasionally man himself, supported from the one or the other, or from both. These are facts, and as facts alone we must receive them, for we have at present no means of reasoning upon them. There are innumerable mysteries in matter as well as in mind ; and we are not yet acquainted with the nature of those elementary principles from which every compound proceeds, and to which every thing is reducible. We are equally ignorant of their shapes, their weight, or their measure.

LECTURE XIII.

ON THE CIRCULATION OF THE BLOOD, RESPIRATION, AND ANIMALIZATION.

The progress of science is slow, and often imperceptible; and though in a few instances it has been quickened by an accidental discovery or an accidental idea, that has given a new turn or a new elasticity to the chain of our reasoning, still have we been compelled in every instance to follow up the chain, link after link, and series after series, and have never leaped forward through an intermediate space without endangering our security, or being obliged to retrace our career by a painful and laborious re-investigation.

It required a period of three thousand six hundred years to render the doctrine of a vacuum probable, and of five thousand six hundred to establish it upon a solid foundation. For its probability we are indebted to Epicurus, for its certainty to Sir Isaac Newton. The present theory of the solar system was commenced by Pythagoras and his disciples five centuries before Christ, and only completed by Copernicus fifteen centuries after Christ. Archimedes was the first who invented the celebrated problem for squaring the parabola, which was upwards of two hundred years before the Christian era; yet an exact problem for squaring the circle is a desideratum in the present day. The simple knowledge of the magnet was familiar to the Romans, Greeks, and some of the oriental nations while in their infancy; it has been employed by the mariner for nearly six centuries in Europe, and for a much longer period by the Chinese, in their own seas; yet at this moment we are acquainted with only a very few of its laws, and have never been able to appropriate it to any other purpose than that of the compass.

The circulation of the blood in the animal system is our subject of study for the present lecture, and it is a subject which has laboured under the same difficulties, and has required as long a period of time as almost any of the preceding sciences, for its complete illustration and establishment. Hippocrates guessed at it; Aristotle believed it; Servetus, who was burnt as a heretic in 1553, taught it; and Harvey, a century afterwards, demonstrated it.

I shall not here enter into the various steps by which this wonderful discovery was at length effected; the difficulty can be only fairly appreciated by those who are acquainted with the infinitely minute tubes into which the distributive arteries branch out, and from which the collective veins arise; but every one is interested in the important fact itself, for it has done more towards establishing the healing art upon a rational basis, and subjecting the different diseases of mankind to a successful mode of practice, than any other discovery that has emblazoned the annals of medicine.

In our last lecture we traced the action of the digestive organs; we beheld the food first comminuted by means of jaws, teeth, or peculiar muscles or membranes; next converted into a pulpy mass, and afterwards into a milky liquid; and in this state drunk up by the mouths of innumerable minute vessels, that progressively unite into one common trunk, and convey it to the heart as the chief organ of the system, for the use and benefit of the whole.

But the new-formed fluid, even at the time it has reached the heart, has by no means undergone a sufficient elaboration to become genuine blood, or to support the living action of the different organs. It has yet to be operated upon by the air, and must for this purpose be sent to the lungs, and again returned to the heart, before it is fitted to be thrown into the general circulation.

This is the rule that takes place in all the more perfect animals, as mammals, birds, and most of the amphibials ;* and hence these classes are said to have a double circulation. And as the heart itself consists of four cavities, a pair belonging to each of the two circulations, and each pair is divided from the other by a strong membrane, they are also said to have not only a double circulation, but a double heart—a pulmonary and a corporeal heart.

The blood is first received into the heart on the pulmonary side, and is conveyed to the lungs by an artery which is hence called the pulmonary artery, that soon divides into two branches, one for each of the lungs ; in which organs they still further divide into innumerable ramifications, and form a beautiful net-work of vessels upon the air-vesicles of which the substance of the lungs consists ; and by this mean every particle of blood is exposed in its turn to the full influence of the vital gases of the atmosphere, and becomes thoroughly assimilated to the nature of the animal system it is to support. The invisibly minute arteries now terminate in equally minute veins, which progressively unite till they centre in four common trunks, which carry back the blood, now thoroughly ventilated and of a florid hue, to the left side or corporeal department of the heart.

From this quarter the corporeal circulation commences : the stimulus of the blood itself excites the heart to that alternate contraction which constitutes pulsation, and which is continued through the whole course of the arteries ; and by this very contraction the blood is impelled to the remotest part of the body, the arterial vessels continuing to divide and to subdivide, and to branch out in every possible direction, till the eye can no longer follow them, even when aided by the best glasses.

The arterial blood having thus visited every portion of every organ, and supplied it with the food of life, is now returned, faint, exhausted, and of a purple hue, by the veins, as in the pulmonary circulation ; it receives, a short space before it reaches the heart, its regular recruit of new matter from the digestive organs, and then empties itself into the right side or pulmonary department of the heart, whence it is again sent to the lungs, as before, for a new supply of vital power.

The circulation of the blood, therefore, depends upon two distinct sets of vessels, arteries, and veins, the former of which carry it forward to every part of the system, and the latter of which return it to its central source. Both sets of vessels are generally considered as consisting of three distinct layers or tunics ; an external, which in the arteries is peculiarly elastic ; a middle, which is muscular in both, but whose existence is doubted by some physiologists ; and an internal, which may be regarded as the common covering or cuticle. The projectile power exercised over the arteries is unquestionably the contraction to which the muscular tunic of the heart is excited by the stimulus of the blood itself; and which contraction would be permanent, but that the heart appears to become exhausted in a considerable degree of its muscular irritability by the exertion that produces the contraction, and hence speedily returns to its prior state of relaxation, exhibiting that alternating succession of systole and diastole which constitutes pulsation.*

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* Cuvier seems to ascribe a double heart to the class of amphibia, without any limitation. See Lawrence's additional note E. chap. xii. of his translation of Blumenbach's System of Comparative Anatomy. Blumenbach himself has remarked, that many of the frogs, lizards, and serpents have a simple heart, consisting of a single auricle and ventricle, like that of fishes. Sect. 162.

In the venal system, however, we meet with even fewer proofs of muscular fibre than in the arterial, and no such force of the heart as to produce pulsation on the pressure of the finger; and hence, to this moment, we are in a greater degree of ignorance as to the projectile power by which this system is actuated. The theories that have been chiefly advanced upon the subject are, first, that of a vis à tergo, or an impetus given to the blood by the arterial contraction, which is supposed by its supporters to be sufficient to operate through the whole length of the venal canals; secondly, that of capillary attraction, the nature of which we explained in a former lecture; and lastly, a theory of a much more complicated kind than either, and which supposes the projectile power to result jointly from the impetus communicated by the heart and arteries, from the pressure of the surrounding organs, and especially from the elasticity of the lungs, and the play of the diaphragm, in conjunction with the natural irritability of the delicate membrane that lines the interior of the veins. It is unnecessary to enter into a consideration of any of these theories; for they all stand self-convicted of incompetency; and the last, which is the most operose of the whole, has been only invented to supply the acknowledged inefficacy of the other two.† Whatever this projectile power consists of, it appears to have some resemblance to that of the vegetable system; and, like many of the vessels in the latter, is assisted by the artifice of numerous valves inserted in different parts of the venal tubes.

The most important process which takes place in the circulation of the blood is that of its ventilation in the lungs. It is this process which constitutes the economy of RESPIRATION, and has till of late been involved in more than Cimmerian darkness.

We see the blood conveyed to the lungs of a deep purple hue, faint and exhausted by being drained in a considerable degree of its vital power, or immature and unassimilated to the nature of the system it is about to support, in consequence of its being received fresh from the lacteal trunk. We behold it returned from the lungs spirited with newness of life, perfect in its conformation, more readily disposed to coagulate, and the dead purple hue transformed into a bright scarlet. How has this wonderful change been accomplished? What has it parted with? what has it received? and by what means has so beneficial a barter been produced?

These are questions which have occupied the attention of physiologists in almost all ages; and though we have not yet attained to any thing like demonstration, or even universally acceded to any common theory, the experiments of modern times have established a variety of very important facts which may ultimately lead to such a theory, and clear away the difficulties by which we are still encumbered.

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* Physiological experiments have sufficiently proved, of late, that the same alternation of contraction and dilatation does not take place in the arteries in a free or natural state; for where there is no resistance to the flow of the blood along their canals, there is no variation in their diameter; and that it is only the pressure of the finger or some other substance against the side of an artery that produces its pulse. Stud. of Med. ii. p. 16. Experimental Inquiry into the Nature, &c. of the Arterial Pulse, by C. H. Parry, M. D. 1816.

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† It has lately been pretty clearly established, that by far the most active power in the return of the blood to the heart from the veins is the comparative vacuum which takes place in the ventricles of the heart, when exhausted of blood by the systole or alternating contraction of this organ; in consequence of which, the venous blood is, as it were, sucked up into the right ventricle from the venæ cavæ, or venous system at large. So that the heart, upon this beautiful principle of simplification, becomes alternately a forcing and a suction pump. By its contraction it forces the blood into the arterial system, and by its vacuum it sucks it up from the venous. See Stud. of Med. ii. p. 19. 2d edit. 1825.

These facts I shall proceed to examine into in language as familiar as I can employ: I must nevertheless presume upon a general acquaintance with the elementary principles and nomenclature of modern chemistry, since a summary survey of zoonomy is not designed to enter into a detail of its mere alphabet or rudiments, but to apply and harmonize detached facts that relate to it, and to condense the materials that have been collected by others into a narrow but regular compass.

The chief substance which has been ascertained to be introduced from the atmosphere into the air-vesicles of the lungs during the act of respiration, and from these into the blood, is oxygene, of which the atmosphere, when pure, consists of about twenty-eight parts in a hundred, the remaining seventy-two being nitrogene.

That this gaseous fluid enters into the lungs is rendered highly probable from a multiplicity of experiments, which concur in proving that a larger portion of oxygene is received by every act of inspiration than is returned by every correspondent act of expiration; and that it passes from the air-vesicles of the lungs into the blood we have also reason to believe from the change of colour which immediately takes place in the latter, and from other experiments made out of the body, as well as in the body, which abundantly ascertain that oxygene has a power of producing this change, and of converting the deep purple of the blood into a bright scarlet.

It is also supposed very generally, that a considerable portion of caloric or the matter of heat, in its elementary form, is communicated to the blood at the same time and in conjunction with the oxygene; but as this substance has hitherto proved imponderable to every scheme that has been devised to ascertain its weight, this continues at present a point avowedly undetermined. That an increase of sensible heat at all times accompanies an increase of respiration is admitted by every one; but since caloric may be obtained by other means, if obtainable at all, and since a denial of its existence as a distinct substance has of late years been as strenuously urged as it was in former times by the Peripatetic school, and upon experiments inaccessible to those philosophers, we are at present in a state of darkness upon this subject, from which I am much afraid we are not likely to be extricated very soon.

I have already observed that nitrogene, or azote as it is also called, is the other gaseous fluid that constitutes the respirable air of the atmosphere. And from a variety of well-conducted experiments by Mr., now Sir Humphry, Davy, it appears also that a certain quantity of this gas is imbibed by the lungs in the same manner they imbibe oxygene, and that like oxygene it is also communicated from the lungs to the blood while circulating through its substance; for, in the experiments adverted to, he found that, as in the case of the oxygene, a smaller quantity was always returned by every successive act of expiration, than had been inhaled by every previous act of inspiration.*

The only gas that seems to have been thrown out from the lungs in the course of these experiments is carbonic acid; a very minute proportion of which appears also to be almost always contained in the atmospheric air, though altogether a foreign material, probably eliminated from the decomposition of animal and vegetable bodies that is perpetually taking place, and certainly unnecessary to healthful respiration.

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* Priestley had before shown that nitrogene is absorbed. See Phil. Trans. 1790. p. 106.

The general result of these experiments was as follows; the natural inspirations were about twenty-six or twenty-seven in a minute; thirteen cubic inches of air were in every instance taken in, and about twelve and three-quarters thrown out by the expiration that succeeded.

The atmospheric or inspired air contained in the thirteen cubic inches, —nine and a half of nitrogene, three and four-tenths of oxygene, and one-tenth of an inch of carbonic acid. The twelve inches and three-quarters of returned air contained nine and three-tenths of nitrogene, two and two-tenths of oxygene, and one and two-tenths of carbonic acid.

This inhalation, however, varies in persons of different sized chests from 26 to 32 cubic inches, at a temperature of 55°; but these, by the heat of the lungs, and saturated with moisture, become forty or forty-one cubic inches.

Taking, therefore, forty cubic inches as the quantity of air equally inhaled and exhaled about twenty times in a minute, it will follow that a full-grown person respires 48,000 cubic inches in an hour, or 1,152,000 cubic inches in the course of a day; a quantity equal to about 79 hogsheads.

A similar train of experiments has more lately been pursued by Messrs. Allen and Pepys, and will be found fully detailed in the Transactions of the Royal Society for 1808. They confirm the preceding proportions, excepting in the retention of nitrogene; this substance having been found by Messrs. Allen and Pepys to have been returned, in every respiration, in the precise proportion in which it was received. It is highly probable, however, that the diet of these two sets of ingenious experimenters had not previously consisted of the same proportion of animal and vegetable materials; and that the blood in the former instance was less charged with nitrogene than in the latter; which would at once account for the difference.

Upon Sir Humphry Davy's experiments, however, the quantity of nitrogene received by the lungs is very inconsiderable, not amounting to more than two-tenths of a cubic inch in an inspiration. And omitting the consideration of this gas, as also that of caloric, on account of the unsettled state of the question, respiration, from this view of the subject, consists merely in the act of receiving oxygene, and throwing out carbonic acid gas; the lungs imbibing and communicating to the system not less than 32.4 cubic inches of the former, and parting with not less than 26.5 of the latter, every minute. So that, taking the gravity of carbonic acid gas, as calculated by Lavoisier, eleven ounces of solid carbon or charcoal are emitted from the lungs every twenty-four hours.*

The whole of the theory and some of the supposed facts here advanced, however, have of late been very considerably disputed by Mr. Ellis, in his Inquiry into the Changes induced on Atmospheric Air by the Germination of Seeds. He concurs with Messrs. Allen and Pepys, in ascertaining that precisely the same quantity of nitrogene is expired as is inspired; but he objects to their conclusion, that the whole of any constituent element of respired air introduced into the air-vesicles, and not returned by the alternate expiration, is *necessarily* conveyed into the blood-vessels, believing that much of this may remain unascertained, in consequence of an increased, but not sensibly increased, expansion of the chest. He admits that carbonic vapour is thrown forth in the quantity usually alleged with every act of expiration ; but he offers evidence to prove that it is the carbone only that is discharged from the animal system, in connexion with the exhaling vapour ; contending that the carbone thus existing is separated from the vapour by its union with *the whole of the oxygene* introduced by the previous act of inspiration by which alone it is converted into carbonic acid gas : for he found the same decomposition of atmospheric air produced by introducing a small bladder, moistened, and filled with any substance, or perfectly empty, and introduced into an inverted glass containing a certain portion of atmospheric air standing upon quicksilver. He denies, therefore, that the air-vessels are in any degree porous to gases of any kind, excepting caloric ; and, consequently, denies that the blood is converted from a deep modena hue into a bright scarlet by its union with oxygene ; believing, or seeming to believe, that this result is entirely produced by the action of the caloric separated in the air-vesicles upon the union of the carbone of the vapour exhaled from their surfaces, with the oxygene introduced by inspiration. So that, according to this theory, respiration is nothing more than an introduction of caloric into the system, and the conversion of a portion of oxygene (the whole received by the act of inspiration) into an equal bulk of carbonic acid by the carbone exhaled from the living organized body. Air, therefore, examined after respiration, is found to differ from the same air before it is breathed in having lost a portion of oxygene, gained an equal volume of carbonic acid, and in being loaded with pure watery vapour, the vapour thrown off from the lungs ; and he has offered an additional proof that the oxygene of the carbonic acid is that introduced in the act of inspiration, by showing, as in the case of breathing hydrogene gas, that no carbonic acid is returned, and apparently none produced.

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* Phil. Trans. 1808, part ii. 249.

In opposition to the hypothesis of Dr. Priestley, he seems to show, and plausibly to establish, that all terrestrial plants, whether growing in absolute darkness, in the shade, or exposed to the direct rays of the sun, are constantly removing a quantity of oxygene from the atmosphere, and substituting an exactly equal volume of carbonic acid ; that they produce this change by emitting from their leaves, flowers, fruits, stems, and roots, and by a process like animal exhalation, carbonaceous matter, which combines with the oxygene of the surrounding air ; and that such a function is essentially necessary to their vital existence. In doing this, however, the carbonaceous matter is given forth more freely from the green parts than from any other, especially when exposed to the direct rays of the sun, by means of its affinity for the calorific rays ; in consequence of which the oxygene of the carbone is set at liberty, and escapes from the cellular texture of the green parts through the external pores ; an action, however, which is not necessary to life, for a plant does not die when this has ceased, while it is equally found to occur in a dead as in a living plant. It was probably this occasional escape of oxygene that induced Priestley to regard it as an invariable and constant process, affording a compensation for the animal carbone thrown into the air, and thus taking from and giving to the animal world what seemed to be mutually demanded.

Mr. Ellis also affirms that all the various colours of vegetables depend on the varied proportion of alkaline and acid matter mixed with the juices of the coloured parts of plants; that green and yellow, for example, are always produced by an excess of alkali in the colourable juices of the leaf or flower; and all the shades of red, by a predominance of acid; while a neutral mixture produces a white. And hence there is most green in the summer season, when the oxygene is parted with most freely, as drawn away by the rays of light; while in autumn, when there is less separation, the other colours of yellow and red are most frequent.

Mr. Ellis has also quoted a variety of experiments on different kinds of fishes, muscles, marine testacea, snails, leeches, zoophytes, and tadpoles, in which it was found that the water wherein these animals had been placed had lost a part of its oxygene, and received an addition of carbonic acid, while its nitrogene had remained unaffected.*

This hypothesis, however, requires confirmation, and is at present open to many objections. If caloric can permeate animal membranes, as Mr. Ellis admits it to do, and unite by chemical affinity with the blood in the blood-vessels, so also may oxygene in certain cases of combination. Mr. Porrett has shown that the Voltaic fluid, when operating upon water, is capable of carrying even water itself through a piece of bladder, and of raising it into a heap against the force of gravitation; and hence other affinities may not only introduce the oxygene of the respired air, or a part of it, into the blood of the blood-vessels in the lungs, through the tissue of the air-cells, but at the same time carry off the superabundant carbone in the form of carbonic acid, instead of its being thrown out in that of carbonic vapour. Nor have we any proof that carbone will dissolve in water, and produce such vapour; and hence such an idea is gratuitous.†

Of the general operation, however, there is no doubt, whatever be the manner in which it is performed: and by such operation the new blood becomes assimilated to the nature of the system it has to nourish; and the old or exhausted blood both relieved from a material that may be said to suffocate it, and reinspirited for fresh action. In this state of perfection, produced from the matter of food introduced into the stomach, and elaborated by the gases of the atmosphere, received chiefly by the act of respiration, but perhaps partly also by the absorbing pores of the skin, the blood on its analysis is found to consist of the following nine parts, independently of its aerial materials:—first, a peculiar aroma, or odour, of which every one must be sensible who has been present at a slaughter-house on cutting up the fresh bodies of oxen; secondly, fibrine, or fibrous matter; thirdly, uncoagulable matter, but no gelatine, which is a subsequent secretion; fourthly, albumen; fifthly, red colouring matter; sixthly, iron; seventhly, sulphur; eighthly, soda; and lastly, water. The proportion of these parts vary almost infinitely, according to the age, temperament, and manner of living; each of these having a character that essentially belongs to it, with particular shades that are often difficult to be laid hold of.

Of these component parts, the most extraordinary are the red colouring matter, the iron, and the sulphur; nor are we by any means acquainted with the mode by which they obtain an existence in the blood. I have already had occasion to observe, that albumen and fibrine are substances formed by the action of the living principle out of the common materials of the food, and that it is probable the lime found in the bones and other parts is produced in the same manner. Whether the iron and sulphur that are traced in the blood have a similar origin, or exist in the different articles of our diet, and are merely separated from the other materials with which they are combined, is a physical problem that yet remains to be solved. It should be observed, however, that the sulphur does not exist in a free state even in the blood itself, but is only a component part of its albumen. Considering the universality of these substances in the blood, and the uniformity of their proportion in similar ages, temperaments, and habits, whatever be the soil on which we reside; that those who live in a country in which these minerals are scarcely to be traced have not less, while those who live in a country that overflows with them have not more; it is perhaps most rational to conclude, that they are generated in the laboratory of the animal system itself, by the all-controlling influence of the living principle.

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* Inquiry into the Changes induced on Atmospheric Air by the Germination of Seeds, &c. 8vo. 1807. As also, Further Inquiries into the Changes, &c. 8vo. 1811.

† Stud. of Med. edit. ii. vol. i. p. 474. Thomson's Annals of Philos. No. xliii. pp. 75, 76.

The exact proportion of sulphur contained in the system has been less accurately ascertained than that of the iron, which last in an adult, the weight of whose blood may be estimated at 28lbs.,* ought usually to amount to seventy scruples, or about three ounces: and hence the blood of about forty men contains iron enough to make a good plough-share, and might easily have its iron extracted from it, be reduced to a metallic state, and manufactured into such an instrument.

Iron is seldom found except in the red particles of the blood;† and it has hence been supposed by the French chemists to be the colouring material itself. The process of respiration, according to the theory of Lavoisier and Fourcroy, is a direct process of combustion in which the animal system finds the carbone, and the atmosphere the oxygene and caloric; and in consequence of the sensible heat which is set at liberty during the combustion, the iron of the blood is converted into a red oxyde, and hence necessarily becomes a pigment.

But it is impossible to ascribe the red colour to this principle: for, first, we are by no means certain that the air communicates any such substance as caloric to the blood; and, secondly, let the sensible heat of the blood arise from whatever quarter it may, it can never be sufficiently augmented by the most violent degree, either of local or general inflammation, to convert the iron of the blood into a red oxyde, which, indeed, is never produced without rapid combustion, flame, and intense heat. And hence, Sir Humphry Davy conjectures the carbon itself of the blood to be the real colouring material, and to be separated from the oxygene, with which it is necessarily united to constitute carbonic acid gas, by the matter of light, which he supposes to be introduced into the system in the act of respiration, instead of the matter of caloric; in consequence of which it immediately becomes a pigment. But the difficulties which attend this theory are almost, if not altogether, as numerous as those which attend the theory of combustion, and it is unnecessary to pursue the subject any farther.

In the Philosophical Transactions, and in several of the best established foreign Memoirs, we meet with a few very curious instances of spontaneous inflammation, or active combustion, having occurred in the human body. The accident has usually been detected by the penetrating smell of burning and sooty films, which have diffused themselves to a considerable distance; and the sufferers have in every instance been discovered dead, with the body more or less completely burnt up, and containing in the burnt parts nothing more than an oily, sooty, extremely fetid and crumbly matter. In one or two instances there has appeared, when the light was totally excluded, a faint lambent flame bickering over the limbs; but the general combustion was so feeble that the chairs and other furniture of the room within the reach of the burning body have in no instance been found more than scorched, and in most instances altogether uninjured.

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* Blumenbach states the proportion in an adult and healthy man to be as 1 to 5 of the entire weight of the body. By experiments on the water-newt (lacerta *palustris*), he found the proportion in this animal to be only as 2½ to 36.

† Mr. Brande denies that iron exists more in the red particles of the blood than in the other principles: according to his experiments, it exists but in a very inconsiderable quantity in any of them; but he has traced it in the chyle, in the serum, and in the fibrine, or washed crassament. Phil. Trans 1812, p. 112. Vauquelin has traced it as a constituent in egg-shells and oyster-shells. Thomson's Annals of Philos. No. 1. p. 66. But Berzelius has proved Brande to be mistaken, and that iron exists largely in the blood, and is the cause of the red colour. See his Anim. Chemistry.

It is by no means easy to explain these extraordinary facts, but they have been too frequent, and are too well authenticated in different countries, to justify our disbelief. In every instance but one the subjects have been females, somewhat advanced in life, and apparently much addicted to spirituous liquors. I shall hence only observe, in few words, that the animal body in itself consists of a variety of combustible materials; and that the process of respiration (though not completely established to be such) has a very near alliance to that of combustion itself: that the usual heat of the blood, taking that of man as our standard, is 98° of Fahrenheit, and under an inflammatory temperament may be 103° or 104°; and hence, though by no means sufficiently exalted for open or manifest combustion, may be more than sufficiently so for a slow or smothered combustion; since the combustion of a dung-hill seldom exceeds 81°, and is not often found higher in fermenting hay-stacks, when they first burst forth into flame. The use of ardent spirits may possibly, in the cases before us, have predisposed the system to so extraordinary an accident; though we all know that this is not a common result of such a habit, mischievous as it is in other respects. The lambent flame emitted from the body is probably phosphorescent, and hence little likely to set fire to the surrounding furniture. It is not certain whether this flame originates spontaneously, or is only spontaneously continued, after having been produced by a lighted substance coming too nearly in contact with a body thus surcharged with inflammable materials.

Such, then, are the circulatory and respiratory systems in the most perfect animals: as mammals, birds, and amphibials. It should be observed, however, that in birds the hollow bones themselves, and a variety of air-cells that are connected with them, constitute, as we have already had occasion to notice,* a part of the general respiratory organ, and endow them with that levity of form which so peculiarly characterizes them, and which is so skilfully adapted to their intention. It should be remarked, also, that in most amphibious animals, and especially in the turtle, whose interior structure is the most perfect of the entire class, the two ventricles, or larger cavities of the heart, communicate something after the manner in which they do in the human fetus. The lungs of this class are for the most part unusually large; and they have a power of extracting oxygene from water as well as from air; whence their capability of existing in both elements. The oxygene, however, obtained from the water is not by a decomposition of the water into its elementary parts, but only by a separation of such air as is loosely combined with it; for if water be deprived of air or oxygene the animal soon expires. We have already observed that some amphibials appear to possess only a single heart, and even that of a very simple structure.

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* Ser. I. Lect. XI. p. 119.

In fishes the heart is single, or consists only of two compartments instead of four, and hence the circulation is single also. The gills in this class answer the intention of lungs, and the blood is sent to them for this purpose from the heart, in order to be deprived of its excess of carbone, and supplied with its deficiency of oxygene. It is not returned to the heart, as in the case of the superior animals, but is immediately distributed over the body by an aorta or large artery issuing from the organ of the gills. The oxygene, in these animals is separated from the water instead of from the air: and for this purpose the water usually passes through the mouth before it reaches the gills: yet in the ray-tribe there is a conducting aperture on each side of the head, through which the water travels instead of through the mouth. In the lamprey it is received by seven apertures opening on each side of the head into bags, which perform the office of gills, and passes out by the same orifices, and not as has been supposed, by a different opening said to constitute its nostril.

In the common leech there are sixteen of these orifices on each side of the belly, which answer the same purpose. In the sea-mouse (aphrodita *aculeata*) "the water passes through the lateral openings between the feet into the cavity under the muscles of the back."*

The siren possesses a singular construction, and exhibits both gills and lungs;† thus uniting the class of fishes with that of amphibials. Linnéus did not know how to arrange this curious animal, and shortly before his death formed a new order of amphibials, which he called MEANTES, for the purpose of receiving it. It ranks usually in the class of fishes.

The only air-vessels of the winged insects have a resemblance to the apertures of the lamprey, and are called stigmata. In most instances these are placed on each side of the body; and each is regarded as a distinct trachea, conducting the air, as M. Cuvier elegantly expresses it, in search of the blood, as the blood has no means of travelling in search of the air.‡ They are of various shapes and number, and are sometimes round, sometimes oval, but more generally elongated like a button-hole. In the grasshopper they are twenty-four, disposed in four distinct rows.

The membranous tube that runs along the back of insects is called by Cuvier the dorsal vessel. It discovers an alternate dilatation and contraction; and is supposed by many naturalists to be a heart, or to answer the purpose of a heart. Cuvier regards it as a mere vestige of a heart without contractions from its own exertion, and without ramifications of any kind: the contractions being chiefly produced by the action of the muscles running along the back and sides, as also by the nerves and tracheæ, or stigmata. Scorpions and spiders have a proper heart: and as the term *insects* is now confined by M. Cuvier and M. Marcel de Serres to those that have only this dorsal vessel, or imperfect heart, the two former genera are struck out of the list of insects as given by Linnéus.§

This organ differs very considerably in its structure and degree of simplicity in molluscous animals. The heart of the teredo has two auricles and two ventricles ; that of the oyster one auricle and one ventricle. In the muscle the heart is not, strictly speaking, divided into an auricle and ventricle, but rather consists of an oval bag, through the middle of which the lower portion of the intestine passes. Two veins from the gills open into the heart, one on each side, which may be considered as the auricles.

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* Sir E. Home, Phil. Trans. 1815, p. 260.

† Home's Life of Hunter, prefixed to Hunter's Treatise on the Blood, Inflammation, &c. p. xli.

‡ En un mot, le sang ne pouvant aller chercher l'air, c'est l'air qui va chercher le sang. Lecons d'Anat. Comp. i. 23. Sect. 2. Art. 5.

§ See M. Marcel de Serres' statement, Tilloch's Journal, vol. xliv. p. 148. ; and especially Thomson's Annals of Phil. No. XXIII. p. 347, 348. 350. 354.

In several of the crustaceous insects of Linnéus, as, for example, the monoculus and craw-fish, the stigmata converge into a cluster, so as to form gills ; which in some species are found seated in the claws, and in other species under the tail. These have for the most part a small single heart, and consequently a single circulation, the course of which, however, is directly the reverse of that pursued in fishes ; for the heart in the present instance propels the blood through the body, and the gills receive it, and propel it to the heart. This is also the case in the snail, slug, and many other soft-bodied worms, which possess a gill in the neck consisting of a single aperture, which it can open or shut at pleasure. Yet, with a singular kind of apparent sportiveness, the cuttle-fish is possest of three distinct hearts, which is one more than is allotted to mankind, in whom this organ is only double.

In zoophytes we are in great ignorance both as to their sanguineous and respiratory functions. That they stand in need of oxygene, and even of nitrogene, has been sufficiently determined by Sir H. Davy ; as it has also that they absorb their oxygene and nitrogene, as fishes do, from the water which holds these gases in solution. Their nutrition appears to be effected by an immediate derivation of the nutritive fluid from their interior cavity into the gelatinous substance of their body.*

Hence, then, the respiratory organs of the animal kingdom may be divided into three classes ; lungs, gills, and holes or stigmata : each of the three classes exhibits a great variety in its form, but the office in which they are employed is the same. Animals of every kind must be supplied with air, or rather with oxygene, however they may differ in other respects in tenacity of life ; for a vacuum, or a medium deprived of oxygene, kills them equally. Snails and slugs corked up in small bottles have been found to live till they had exhausted the air of every particle of oxygene, and to die immediately afterwards : and frogs and land-turtles, which are well known to survive the loss of the spinal marrow for months, and that of the head or heart for several days, die almost instantly on exposure to a vacuum.†

Connected with this general subject, there is still an important question to be resolved, and which has greatly occupied the attention of physiologists for the last fifty years.

Mediately or immediately, almost all animal nutriment, and consequently almost all animal organization, is derived from a vegetable source. The blade of grass becomes a muscular fibre, and the root of a yam or a potato a human brain. What, then, is that wonderful process which assimilates substances in themselves so unlike ? that converts the vegetable into an animal form, and endows it with animal powers ?

Now, to be able to reply succinctly to this question, it is necessary first of all to inquire into the chief feature in which animal and vegetable substances agree, and the chief feature in which they differ.

Animals and vegetables, then, agree in their equal necessity of extracting a certain sweet and saccharine fluid, as the basis of their support, from whatever substances may for this purpose be applied to their respective organs of digestion. Animal chyle and vegetable sap make a very close approach to each other in their constituent principles, as well as in their external appearance. In this respect plants and animals agree. They disagree, inasmuch as animal substances possess a very large proportion of azote, with a small comparative proportion of carbone; while vegetable substances, on the contrary, possess a very large proportion of carbone, with a small comparative proportion of azote. And it is hence obvious, that vegetable matter can only be assimilated to animal by parting with its excess of carbone, and filling up its deficiency of azote.

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* Blumenbach, § 167.

† See Encyclop. Brit. art. Physiol. p. 679.

Vegetable substances, then, part first of all with a considerable portion of their excess of carbone in the stomach and intestinal canal, during the process of digestion; a certain quantity of the carbone detaching a certain quantity of the oxygene existing in these organs, as an elementary part of the air or water they contain, in consequence of its closer affinity to oxygene, and producing carbonic acid gas; a fact which has been clearly ascertained by a variety of experiments by M. Jurine of Geneva. A surplus of carbone, however, still enters the animal system through the medium of the lacteals, and continues to circulate with the chyle, or the blood, till it reaches the lungs. Here again a certain portion of carbone is perpetually parted with upon every expiration, in the form of carbonic vapour, according to Mr. Ellis, but, according to Sir H. Davy and others, in that of carbonic gas, in consequence of its union with a part of the oxygene introduced into the lungs with every returning inspiration;[*] while the excess that yet remains is carried off by the skin in consequence of its contact with atmospheric air; a fact put beyond all doubt by the experiments and observations of M. Jurine, although, on a superficial view, opposed by a few experiments of Mr. Ingenhouz,[†] and obvious to every one, from the well-known circumstance that the purest linen, upon the purest skin, in the purest atmosphere, soon becomes discoloured.

In this way, then, and by this triple co-operation of the stomach, the lungs, and the skin, vegetable matter, in its conversion into animal, parts with the whole of its excess of carbone.

Its deficiency of azote becomes supplied in a two-fold method: first, at the lungs; also, by the process of respiration, as should appear from the concurrent experiments of Dr. Priestley and Sir H. Davy,[‡] which agree in showing that a larger portion of azote is inhaled upon every inspiration, than is returned by every succeeding expiration; in consequence of which the portion retained in the lungs seems to enter into the system, in the same manner as the retained oxygene, and perhaps in conjunction with it; while in union with this economy of the lungs, the skin also absorbs a considerable quantity of azote, and thus completes the supply that is necessary for the animalization of vegetable food:[§] evincing hereby a double consent of action in these two organs, and giving us some insight into the mode by which insects and worms, which are totally destitute of lungs, are capable of employing the skin as a substitute for lungs, by breathing through the spiracles existing in the skin for this purpose, or merely through the common pores of the skin, without any such additional mechanism. It is by this mode, also, that respiration takes place through the whole vegetable world, offering us another instance of resemblance to many parts of the animal; in consequence of which, insects, worms, and the leaves of vegetables, equally perish by being smeared over with oil, or any other viscous fluid that obstructs their cutaneous orifices.

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[*] See Sir H. Davy's Researches Chemical and Philosophical, &c.; and Memoire sur la Chaleur, par M. M. Lavoisier et De la Place. Mem. de l'Acad. De la Combustion, &c.

[†] Essaie de Theorie sur l'Animalization et l'Assimilation des Alimens, &c., Annales de Chimie, tom. ii.

[‡] See Davy's Researches Chemical and Philosophical, &c. and Priestley's Experiments and Observations on different Kinds of Air, vol. iii.

[§] M. Jurine is chiefly entitled to the honour of this discovery; his experiments coincide with several of Dr. Priestley's results, and have been since confirmed by other experiments of M. M. Lavoisier and Fourcroy. See Premier Memoire sur la Transpiration des Animaux, par A. Seguin et Lavoisier, 1792; and compare with M. Hassenfratz's Memoire sur la Combinaison de l'Oxygene, &c., Acad. des Scien. 1791.

But to complete the great circle of universal action, and to preserve the important balance of nature in a state of equipoise, it is necessary, also, to inquire by what means animal matter is reconverted into vegetable, so as to afford to plants the same basis of nutriment which plants have previously afforded to animals?

Now, this is for the most part obtained by the process of PUTREFACTION, or a return of the constituent principles of animal matter to their original affinities, from which they have been inflicted by the superior control of the vital principle, so long as it inhabited the animal frame, and coerced into other combinations and productions.* Putrefaction is, therefore, to be regarded as a very important link in the great chain of universal life and harmony.

The constituent principles of animal matter we have already enumerated: they are most of them compound substances, and fall back into their respective primordia as the putrefactive process sets them at liberty. This process commences among the constituent gases; and it is only necessary to notice the respective changes that take place in this quarter, as every other change is an induced result.

Of these gases I have already observed, that azote or nitrogene is by far the largest in respect of quantity, and it appears also to be by far the most active. Hence, on the cessation of the vital principle, the azotic corpuscles very speedily make an advance towards those of oxygene, and generally in the softer and more fluid parts of the system; the control of the vital principle being here looser and less powerfully exerted. An union readily takes place between the two, and thus combined they fly off in the form of nitric acid; while at the same time another portion of azote combines with some portion of hydrogene, and escapes in the form of ammonia or volatile alkali. A spontaneous decomposition having thus commenced, all the other component parts of the lifeless machine are set at liberty, and fly off either separately, or in different combinations; during which series of actions, from the union of hydrogene and carbone, and especially if conjoined at the same time with some portion of phosphorus or sulphur, is thrown forth that offensive aura which is the peculiar characteristic of the putrefactive process, and which, according to the particular mode in which the different elementary substances combine, constitutes the fetor that escapes from putrid fishes, rotten eggs, or any other decomposing animal substances.

In this manner, then, by simple, binary, or ternary attractions and combinations, the whole of the substance constituting the animal system, when destitute of its vital principle, flies off progressively to convey new pabulum to the world of vegetation; and nothing is left behind but lime or the earth of bones, and soil or the earth of vegetables; the former furnishing plants with a perpetual stimulus by the eagerness with which it imbibes oxygene, and the latter offering them a food ready prepared for their digestive organs.

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* It should hence appear, that putrefaction is the only positive criterion of death, or the total cessation of the principle of life. Galvanism has, indeed, been advanced as a decisive proof of the same by Behrends and Creve; but Homboldt has sufficiently shown its insecurity as an infallible test.

In order, however, that putrefaction should take place, it is necessary that certain accessaries to such a process should be present, without which putrefaction will never follow. Of these the chief are rest, air, moisture, and heat.

Without REST the putrefactive process in no instance takes place readily, and in some instances does not take place at all: for animal flesh, when exposed to the perpetual action of running water, is often found converted into one common mass of fat or spermaceti, as I shall presently have occasion to observe more minutely.

AIR must necessarily co-exist, for putrefaction can never be induced in a vacuum. Yet we must not only have air, but genuine atmospheric air; or, in other words, the surrounding medium must be compounded of the gases which constitute the air of the atmosphere, and in their just proportions. To prove this, it is sufficient to mention that dead animal substance has been exposed by M. Morveau,[*] and other chemists, for five or six years in confined vessels, to the action of simple nitrogene, hydrogene, carbone, and various other gases, without any change that can be entitled to the appellation of putrefaction.

There must also be MOISTURE; for, as I have already observed, putrefaction commences in the softer and more fluid parts of the animal system. On this account it rarely occurs during a sere harmattan or drying wind of any kind, and never in a frost so severe as to destroy all moisture whatsoever; the power of frost exercising quite as effective a control over the elements of animal matter as the living principle itself.

For the same reason there must be HEAT; since in the total absence of heat frost must necessarily take place, together with an entire privation of moisture. On this last account, again, the heat made use of must only be to a certain extent, as about $65\frac{1}{2}°$ of Fahrenheit; for, if carried much higher, the rarefaction which takes place in the surrounding atmosphere will induce an assent of all the fluids in the animal substance towards its surface; whence they will fly off in the form of vapour, before the putrefying process can have had time to commence, and leave nothing behind but dry indurated materials, incapable of putrefaction because destitute of all moisture. Our dinner tables too often supply us with instances of this fact, in dishes of roast or boiled meat too long exposed to the action of the fire, and hence reduced to juiceless and ragged fibres, totally devoid of nutriment, and capable of keeping for weeks or months, without betraying any putrefactive indication.

In like manner, when bodies are buried beneath the hot and arid sands of Egypt or Arabia, with a sultry sun shining, almost without ceasing, upon the sandy surface, the heat hereby produced is so considerable as to raise the whole of the fluids of the animal system to the cuticle, whence they are immediately and voraciously drunk up by the bibulous sands that surround it; or, piercing their interstices, are thrown off into the atmosphere in the form of insensible vapour. In consequence of which, when a body thus buried is dug up a few weeks after its interment, instead of being converted into its original elements, it is found changed into a natural mummy, altogether as hard and as capable of preservation as any artificial mummy, prepared with the costliest septics employed on such occasions.

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[*] See Memoire sur la Nature des Fluides elastiques aeriformes, qui se degagent de quelques Matieres animales, &c. par M. Lavoisier, Mem. de l'Acad. 1782; as also, M. Brugnatelli's paper in Crell's Chemical Annals for 1708, Ueber die Faulung thierischer theile in verschieden Luftarten.

When dead animal organs are deposited in situations in which only a very small portion of atmospheric air is capable of having access to them, a change indeed takes place, but of a very different description from that of putrefaction, and which is of a most curious and extraordinary nature. For in such cases the animal organs, instead of being converted into their original elements, are transmuted into fat, wax, or spermaceti; or rather into a substance *sui generis*, and possessing a middle nature between that of the two former, whence the French chemists have given it the appellation of ADIPOCIRE; a term not strictly classical, but for which the chemists of our own country have not hitherto substituted any other.

This result is observed, not unfrequently, in bodies that are drowned, and rendered incapable of rising to the surface of the water; for in such a situation but very little air, and consequently very little oxygene, can reach them from the external atmosphere. And it is to these circumstances we ought, perhaps, to resolve the singular appearance in the body of Colonel Pollen, who was wrecked a few years ago in the Baltic Sea, near Memel, and within sight of the coast; and whose corpse was six months afterwards thrown on shore, with the features of the face so little varied, that every one of his acquaintances recognised him at the first glance. The body had probably been entangled in the submarine sands on first sinking, and been retained in this situation for months, cut off from that exposure to external air which is absolutely necessary in all cases of patrefaction properly so called. A similar conversion into wax-fat was observed also in 1786 and 1787, on opening the *fosses communes*, or common burial pits in the churchyard of the Innocents at Paris, for the purpose of laying the foundation of a new pile of buildings. For the bodies that on this occasion were dug up, instead of being dissolved into their elementary corpuscles, were found for the most part converted into this very substance of waxy fat or adipocire. The populace were alarmed at the phænomenon, and the chemists were applied to for an explanation. M. Fourcroy, among others, attended upon this occasion; and his solution, which will apply to all cases of a similar kind, referred the whole to the extreme difficulty with which external air had obtained any communication with the inhumed bodies, in consequence of the close adaptation of coffin to coffin, and the compactness with which every pit had been filled up. Difficult, however, as this communication must have been, he conceived that, from the natural elasticity of atmospheric air, some small portion of it had still entered, conveying, perhaps, just oxygene enough to excite the new action of decomposition. This having commenced, the constituent oxygene of the dead animal organs would itself be progressively disengaged, and rapaciously laid hold of by all the other constituent principles, from their strong and general affinity to it. During this gradual evolution, there can be little doubt that the greater part of it would be seized by the predominant azote, a very considerable part by the carbone, and the rest by the hydrogene; and the result would be, upon the total but very slow escape of the constituent and disengaged oxygene, that the whole or nearly the whole of the azote, a considerable portion of the carbone, and a certain quantity of the hydrogene, would escape also—leaving behind the remainder of the carbone and the hydrogene, now incapable of escape from the want of oxygene to give wings to their flight, together with the residual earth of the animal machine.

But hydrogene and carbone, though in this case incapable of sublimation for want of oxygene, would still, from their mutual attraction and juxta-position, enter into a new union and produce a new result, and this result must necessarily be fat; for fat is nothing else than a combination, in given proportions, of carbone and hydrogene. And hence, whatever the respective animal organs of the bodies deposited in these burial caverns may have antecedently consisted of, whether muscle, ligament, tendon, skin, or cellular substance, when thus deprived of their oxygene and azote, the whole must of necessity be converted into fat. Pure and genuine fat it would have been, provided there had been nothing left behind but mere carbone and hydrogene, and in their respective proportions for the formation of fat; but as we can scarcely conceive such proportions could take place, or that every corpuscle of the azote could be carried off before the total escape of the oxygene, many parts of it must necessarily have assumed a flaky; soapy, or waxy appearance, from the union of the azote left behind, with some portion of the hydrogene, and the consequent production of ammonia or volatile alkali; since, by an intermixture of alkali with fat, every one knows that soap or a saponaceous substance is uniformly produced.

But, excepting in situations of this kind, in reality, in every situation in which dead animal matter, destitute of its living principle, is exposed to the usual auxiliaries of putrefaction, putrefaction will necessarily ensue, and the balance will be fairly maintained:—the common elements of vital organization will be set at liberty to commence a new career, and the animal world will restore to the vegetable the whole which it has antecedently derived from it.

In this manner is it, then, that nature, or rather that the God of nature, is for ever unfolding that simple but beautiful round of action, that circle of eternal motion, in which every link maintains its relative importance, and the happiness of every part flows from the harmony of the whole. Can we, then, do better than conclude with the correct and spirited apostrophe of one of our most celebrated poets:—

Look round the world! behold the chain of love
Combining all below and all above.
See plastic nature working to this end;
Atoms to atoms—clods to crystals tend.*
See dying vegetables life sustain;
See life dissolving, vegetate again.—
All serv'd, all serving, nothing stands alone,
The chain holds on, and where it ends unknown.

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* This line is altered to answer the present purpose in a better manner.

LECTURE XIV.

ON THE PROCESS OF ASSIMILATION AND NUTRITION; AND THE CURIOUS EFFECTS TO WHICH THEY LEAD.

We have traced out in our preceding studies something of the means by which form, and magnitude, and motion, are produced in the inorganized world:—how the various substances that surround us combine and separate, vanish from us and re-appear, and, in the multifarious processes they undergo, give rise to new products by new and perpetually shifting involutions. We have further traced an outline of the means by which organized matter is capable of building up the curious structures of plants and animals; how the chief functions they possess are carried on, and by what means they respectively acquire maturity and perfection.

But it is not only necessary that the system should in this manner be matured and perfected by a fresh application of materials, but that the old materials which constitute every organ should be progressively removed from the system, in consequence of their being worn out by use, and their place supplied from definite stores. Let us, then, devote the present hour to an inquiry how this latter change occurs in vascular and living matter, in the vegetable and animal system: by what means the dead or exhausted and worn-out elements of the different organs are carried off, and replaced by new reformative materials, and what are the principal phænomena that result from such a series of operations.

The blood, then, in animals, and the sap, which may be regarded as a species of blood, in plants, of both which we have already treated, are the vital currents from which every organ of the individual frame derives the nourishment it stands in need of, and into which it pours ultimately a considerable portion of its waste and eliminated fragments; for the provident frugality of nature suffers nothing to be lost, and, as far as possible, works up the old materials, time after time, into fresh food for the subsistence of the entire system.

To produce this double purpose two distinct sets of vessels are necessary: one for that of separating from the common mass of the blood, and re-combining into new associations, those particular parts of it which the formation of the fresh matter demands; and the other for that of carrying back the rejected materials into the general current. And hence these two sets of vessels bear the same relation to each other as the veins and arteries of the animal frame, accompany every part of the frame to its farthest extremities, and, indeed, constitute the general mass of the frame itself. From the respective offices they perform, they are denominated SECERNENT and ABSORBENT systems; in their utmost ramifications they are too minute to be traced by the keenest eye, or the nicest experiment of the anatomist; but, where they are not quite so minute, they are sufficiently discoverable, and their course is sufficiently capable of being followed up, from the delicate apertures or mouths by which, in infinite numbers, they open on all animal surfaces, or hollows whatever, to their incipient sources.

The SECERNENTS, or that set of vessels whose office it is to separate particular parts from the blood for particular purposes, are evidently continuations of some of those very subtile ramifications of the arteries which, on account of their fineness, are called capillary; and the ABSORBENTS, or that set of vessels whose office it is to imbibe or drink up the waste and exhausted materials, are as evidently distinct and attenuate tubes, progressively uniting, and ultimately emptying themselves into the venous system, the common trunk in which they concentre, and in which also concentre the lacteals of the alimentary canal, named the thoracic duct, being a tough membranous channel situate upon the interior part of the spine, of about the diameter of a crow-quill in man, and running in a serpentine direction through the diaphragm or midriff to an angle formed by an union of the jugular and subclavian veins, into which it opens, and where of course it terminates, leaving the waste and the new food, now intimately intermixed, to be still farther elaborated and refitted for use by those subsequent and specific operations of the heart and the lungs which we have already described.*

The simplest action, perhaps, that is evinced by the mouths of the secretory or secernent vessels, consists in separating and throwing forth a fine lymph from the surface of all membranes and organs whatever, for the purpose of lubricating them, as we grease the axle-tree of our carriage wheels; and thus preventing one membrane or organ from being injured by the friction of another. Of this every one who has been present on the cutting up of slaughtered oxen must have seen an abundant and striking instance, in the vapour that ascends from every part of the warm carcass, which vapour, when condensed by cold or any other cause, is found to be little more than the serum or watery part of the blood. And one of the simplest actions evinced by the mouths of the absorbent vessels, consists in their drinking up, as with a sponge, this attenuate or lymphatic fluid, when it has answered its purpose, so as to make room for a fresh and perpetual effusion; whence these vessels are often called LYMPHATIC, as well as absorbent, in consequence of their being so frequently found loaded with this fine and colourless material.

And here, perhaps, the first remark that must occur to every one is the necessity there seems to exist, that these correspondent systems of vessels should maintain the nicest harmony or balance in their respective functions; since, if the one operate either with a less or a larger power than the other, disease must inevitably follow; the nature of the malady being determined by the nature of the cause that produces it.

We have all of us heard, and most of us have seen instances of the disorder called dropsy; and many of us have surveyed it both in a local and a general form, as dropsy of the head, dropsy of the chest, dropsy of the abdomen, and dropsy of the cellular membrane or system at large. This disease may take place from two causes; as, for example, from a too great excitement of the secernent system, or a too little excitement of the absorbent. If, from a morbid irritability in the secernent vessels of any one of the cavities I have just adverted to, an undue proportion of lubricating lymph be secreted and steam forth, the natural tone and action of the correspondent absorbent vessels will not be sufficient to carry off the surplus; and hence that surplus will accumulate, and dropsy ensue, although the absorbent vessels of the part affected be in a state of usual health and vigour: the disease depending altogether on the morbid and predominant excitement of the secernents.

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* This double action by a double set of vessels was little, if at all, known to the ancients, who referred the economy of both secretion and absorption to the powers of peculiar arteries and veins; and hence, the porosity of these vessels was a doctrine in common belief, till the time of Hewson, Hunter, and Cruickshank. M. Magendie and M. Flandrin, of Paris, have of late been very active in establishing a view of the subject in many respects not essentially different from that of the old school, and in teaching that the only general absorbents are the veins; that the lacteals absorb food, but nothing else; and that the lymphatics have no absorbent power whatever. Their experiments are plausible and striking, but by no means decisive enough to subvert the system explained above. The argument on both sides may be found in the author's Study of Medicine, Vol. v. p. 278, edit. 2d. 1825.

But suppose the absorbent vessels of a particular cavity, in consequence of cold, exhaustion from great previous exercise, or any other cause, to be rendered torpid and inert, and consequently incapable of continuing their accustomed measure of action: in this case dropsy will also ensue, notwithstanding the corresponding secernent vessels are in a state of natural health, and no larger portion of lymph is secreted than a state of natural health demands; for the fluid will now accumulate, from the morbid torpitude of the absorbent system, and its inability to fulfil its function. It is hence, as every one must perceive, a point of the utmost consequence to determine the nature of the cause in dropsy, as, in truth, it is in every other disease, before we attempt a remedy; since an error upon this subject may be productive of the most serious, and indeed fatal consequences. For it is obvious that we may stimulate where we ought to diminish action, or we may diminish action where we ought to stimulate.

Occasionally, however, the action is equally increased in both sets of vessels; as, for example, in inflammation of the leg or arm; and in this case there is great heat and dryness, and at the same time considerable intumescence or swelling. For under this affection the mouths of the secernent vessels, being more distended than in a natural state, pour forth the coagulable lymph in a grosser and less attenuate form, and not unfrequently, perhaps, intermixed with some particles of red blood; while the mouths of the absorbents, though they as eagerly drink up the finer parts of what is thus rapidly strained off, are incapable of carrying away with equal ease those of a grosser texture; in consequence of which these last remain behind, and produce tumefaction by their accumulation.

At times, also, we meet with an equal degree of diminished instead of increased action in both these sets of vessels; as on exposure to cold and damp temperatures; in cases of spare and coarse diet; or of old age. And the result of this double decrease of energy is dryness, as in the former instance, but combined with leanness and corrugation of the organs that are thus affected. It is hence the bones of old people are more easily broken, and the skin is harsher and more wrinkled than in the middle of life; hence the shrivelled and squalid appearance of gipsies and beggars; and hence, in a considerable degree, the low and stinted stature of the Esquimaux, Laplanders, and Tongooses.

For all the usual purposes of health and organic nutrition, the common action and common degree of action evinced by these respondent systems of vessels are perfectly sufficient, though not more than sufficient. It may happen, however, that in consequence of severe violence from external injury or internal disease, a considerable portion of an organ, as a part of some of the muscles that belong to an arm or a leg, may be totally destroyed or killed, and consequently rendered incapable of performing its proper function. How is nature, or, which is the same thing, the remedial principle of life, to act in such circumstances? If the dead part remain, it is manifest that it must impede the living parts that surround it in the execution of their appropriate office; independently of which they want the space which the dead part occupies, and the aid which it formerly contributed. It is obvious that two processes are here necessary: the dead part must be carried off, and its post must be filled up by a substitute of new matter possessing the precise properties of the old. And here we meet with a clear and striking instance of that wonderful instinctive power which pervades every portion of the vital systems, both of the animal and vegetable world, and which is perpetually prompting them to a repair of whatever evils they may encounter, by the most skilful and definite methods.

In order to comply with this double demand of carrying off the dead matter, and of providing a substitute of new, each of the systems before us commences, in the living substance that immediately surrounds that which requires removal, a new mode and a new degree of action. A boundary line is first instinctively drawn between the dead and useless, and the living and active parts; and the latter retract and separate themselves from the former, as though the two had been skilfully divided by a knife. This process being completed, the mouths of the surrounding absorbent vessels set to work with new and increased power, and drink up and carry off whatever the material may be of which the dead part consists, whether fat, muscle, ligament, cartilage, or bone; the whole is equally imbibed and taken away, and the hollow is produced, where the dead part existed. At the same time the mouths of the corresponding secernent vessels commence a similar increase and newness of action, and instead of the usual lymph, pour forth into the hollow a soft, bland, creamy, and inodorous fluid which is denominated pus; that progressively fills up the cavity, presses gradually against the superincumbent skin, in the gentlest manner possible distends and attenuates it, and at length bursts it open, and exposes the whole of the interior to the action of the gases of the atmosphere.

It was at one time conceived, and by writers of considerable eminence and judgment, and of as late a date as the time of Mr. Hewson, that the injured and dead parts were themselves dissolved and converted into pus; but this opinion has been disproved in the most satisfactory manner by the minute and accurate experiments of Mr. John Hunter, Sir Everard Home, and Mr. Cruickshank; and the process has been completely established as I have now related it.

In what immediate way the gases of the atmosphere operate so as to assist the secernent mouths of what is now the clean and exposed surface of a wound, in producing incarnation, or the formation of new matter of the very same kind and power as that which has been carried off, and enable them to fill up the cavity with such new matter, and perfect the cure, we do not exactly know. Various theories have been offered upon this very curious subject; but at present they are theories, and nothing more; and I shall not, therefore, detain you with a relation of them. Thus much, however, we do know, that the co-operation of the atmosphere with the action of the mouths of the secernent system engaged in the work of restoration is, in some way or other, peculiarly beneficial; and that, generally speaking, the wider the opening, and the freer the access of atmospheric air of a due temperature to the surface of the wound, or, which is the same thing, the freer it comes in contact with the mouths of the secernent vessels, the more rapidly and auspiciously the work of impletion and assimilation proceeds. Neither do we know, precisely, why pus, rather than any other kind of fluid, should in the first instance be poured forth, for the purpose of filling up the hollow, and producing a rupture of the skin; but we know to a certainty that some such general process is in most cases absolutely necessary; we know that such a rupture must take place in the natural mode of cure; that the atmosphere must come into close contact with the mouths of the restorative secernents; that a milder or softer fluid could not possibly be secreted for such a purpose; and that the entire process exhibits proofs of most admirable skill and sagacity. It is at times possible for us to assist the process by the lancet, which accelerates the opening. Yet even in this case we do no more than assist it, and are only, as we ought ever to be in all similar cases, humble coadjutors and imitators of nature, and admirers of that all-perfect and ever-present wisdom which we are so often called upon to witness, but are never capable of rivalling.

A process closely similar to this is perpetually unfolding in vegetable life. And it was merely by taking advantage of this process that Mr. Forsythe was able to make old, but well-rooted, stumps of fruit-trees throw forth, far more rapidly than he could saplings, a thrifty family of vigorous and well-bearing shoots: for the compost for which he was so celebrated does nothing more than merely increase the secernent and absorbent action of the vegetable frame by its stimulating property, and defend the wounded part to which it is applied from being injured by the inclemency of the weather.

From what has thus far been observed it appears obvious that all the different parts of the living body are assimilating organs, or, in other words, are capable of converting the common nutriment of the blood into their own respective natures, and for their own respective uses. And it has also appeared, that under particular circumstances every part is capable, moreover, of secreting a material different from that of its own nature, as, for example, the material of pus, whenever such a substance is necessary.

This view of the subject will lead us to understand with facility how it is possible for various organs of the system to maintain two distinct secretions at the same time: one of a matter similar to its own substance, and exclusively for its own use; and another of a matter distinct from its own substance, and in many instances subservient to the system in general. Of this last kind are the stomach, the liver, the respiratory organ, and the brain: each of which secretes, independently of the matter for its own nourishment, a matter absolutely necessary to the health and perfection of the general machine; as the gastric juice, the curious and wonderful properties of which I described on a former occasion; the oxygenous principle of the inspired air, and, as some suppose, those of light or caloric; the bile; and the nervous fluid, or material of sensation.

There are various other organs of a smaller kind, and simpler texture, which also perform the same double office, and secrete materials of a much more local use, or which are intended to be altogether thrown away from the system, as waste or noxious bodies. And to the one or the other of these classes belong the kidneys, the intestinal tube, the minute and very simple perspiratory follicles of the skin, the delicate organs that separate the saliva and mucus that serve to lubricate the mouth and nostrils, and those that elaborate the tears, the wax of the inner ear, and the fat.

The organs, of whatever size or texture, that perform this double function, are called secretory glands; and they are distinguished into different sets, either from their peculiar office or peculiar structure; as salivary, lachrymal, mucous, which are denominated from the former character, and apply to the smallest and simplest of them; conglobate, which are of a larger form, and of an intricate convolution, and belong exclusively to the absorbent system,—as the mysenteric and lumbar; and glomerate and conglomerate, which are composed of a congeries of sanguineous vessels, without any cavity, but with one or more mouths, or excretory ducts as they are called, which, in the latter, open into one common trunk,—as the mammary and pancreatic; both which kinds are denominated from the character of their structure.

It is by this peculiar organization in animals and plants that all those nice and infinitely varying exhalations or other fluids are thrown forth from different parts of them, by which such parts, or the whole individual, or the entire species of individuals, are respectively characterized. Our own senses are too dull to trace a discharge of any kind of essence or vapour from the surface of the human skin in its ordinary action; but the discoloration which soon takes place upon the purest linen, when worn in the purest atmosphere, sufficiently proves the existence of such an efflux; and there are various animals whose olfactory organs are much acuter than our own, as our domestic dogs, for example, that are able to discern a difference in the odour of the vapour which issues from the skin of every individual, and that in fact identify their respective masters, and distinguish them from other individuals by this character alone.

It is to this sense chiefly that quadrupeds, birds, fishes, and most insect tribes trust themselves, in their search after food; and hence the superior acuteness of this power in animals of such kinds, is a strong proof of that unerring wisdom which regulates the world, and is equally conspicuous in every part of it. Under peculiar circumstances, however, the sense of smell appears to be far more lively among mankind than when such circumstances do not exist. M. Virey, who has written a very learned treatise upon this subject, asserts, that it occurs among savages in a far higher degree of activity than among civilized nations, whose olfactory nerves are blunted by an habitual exposure to strong odours, or intricate combination of odours, and by the use of high-flavoured foods. And among persons in a keen morbid state of irritability it has been often found, even in civilized life, much sharper than among savages. The Journal des Sçavans, an. 1667, gives a curious history of a monk, who was said to be able to ascertain, by the difference of odour alone, the sex and age of a person, whether he were married or single, and the manner of life to which he was accustomed.*

When the exhalation from the human skin is increased by muscular exercise, or any other exertion, it is rendered visible; and in this state it is generally found to combine with it a certain portion of dissolved animal oil or fat. Even without much increased action of the system, it is possible at times to obtain a knowledge of its existence under particular circumstances, or by particular applications. Thus, in cold subterraneous caverns, where the air is dense and heavy, the natural evaporation often escapes from the surface of the body in the form of thick clouds; and a bright mirror, when held near a warm and naked skin, in the temperature of the atmosphere, soon becomes obscured by a moist vapour.

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* In a paper on the Petiveria, in the Swedish Academy Transactions, there are a variety of curious observations on the peculiar properties given to the smell, flesh, &c. of different animals, in consequence of their feeding on different foods. It is entitled Petiveria, en Americanek vaxt. Anal. Trans. tom. i. p. 346.

The quantity of this fluid discharged, either in a state of quiescence or of increased action, has not been determined with any great degree of exactness. According to M. de Sauvages,* a man of middle stature and age weighing 146 lbs., takes daily of food and drink about 56 ounces (circiter quinquaginta sex uncias,) his dinner being about twice as much as his supper. In the same period he perspires about 28 ounces; viz. about twelve during the third part of his time in which he sleeps, and sixteen during the two-thirds in which he is awake. It appears certain from the experiments of Gorter, that the weight of the body is more diminished by the same quantity of sweat than of mere perspiration.

Sanctorius, whose experiments of measuring the weight of the body were made in the warm climate of Italy, ascertained, that in that region eight pounds of food received by the mouth were, by the different insensible secretions, reduced to three; making the proportion of insensible exhalation as five to eight. In cold climates, however, it has been determined, that it does not amount to more than two-thirds of this proportion; and of either quantity, it has lately been very satisfactorily established, that more than half this secretion has been thrown forth from the surface of the lungs; which I estimated in a previous lecture, and from the experiments and calculations of Lavoisier, as discharging not less than eleven ounces of solid carbone or charcoal in every four-and-twenty hours.†

Plants transpire precisely in the same way, and to a much greater extent, through the medium of their leaves; which, while they form a great part of their cuticle, may, as I have observed on a former occasion,‡ be also contemplated as their lungs. Hales calculated that a sun-flower, three feet high, transmits in twelve hours one pound four ounces of fluid by avoirdupois weight. Bishop Watson put an inverted glass vessel of the capacity of twenty cubic inches on grass which had been cut during a very intense heat of the sun, and after many weeks had passed without rain; in two minutes it was filled with vapour, which trickled with drops down its sides. He collected these on a piece of muslin, carefully weighed, and repeated the experiment for several days between twelve and three o'clock; and estimated, as the result of his experiment, that an acre of grass land transpires in twenty-four hours not less than 6,400 quarts of water. Dalton, for dew and rain together, makes the mean of England and Wales 36 inches, thus amounting, in a year, to 28 cubic miles of water. Grew, in 1711, calculated the number of acres in South Britain at 46,800,000, and allowed a million to Holland.§ Smith, for England alone, gives $73\frac{1}{4}$ millions in the present day.||

But the same general surface in animals and vegetables that thus largely secretes delicate fluids, largely also imbibes them by the corresponding system of absorbent vessels, opening with their spongy mouths or ducts in every direction. Hales ascertained that the above sun-flower, which threw off not less than twenty ounces of fluid in twelve hours, suspended its evaporation as soon as the dew fell, and absorbed two or three ounces of the dew instead. And among animals, and especially among mankind, the manifest operations of medicines, and other foreign substances, merely diffused through the air, or simply applied to the skin; of various vapours, as those of mercury, turpentine, and saffron; of various baths, as

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* Nosol. Method. ii. 369.

† Ser. I Lect. XIII.

‡ Ser. I. Lect. IX.

§ Phil. Trans. for 1811, p. 265.

|| Phil. Mag. xix. 197. Young's Nat. Phil. ii. 369.

of tobacco, bitter apple, opium, cantharides, arsenic, and other poisons, producing the most fatal effects, and altogether absorbed by the skin, are decisive and incontrovertible proofs of such an action. It is hence the bradypus, or sloth, supports itself without drinking, perhaps at any time, and the ostrich and camel for very long periods, though the latter is also possest of a natural reservoir. And hence the chief impletion of the human body, in many cases of abdominal dropsy: since persons labouring under this disease have often been observed to fill with rapidity during the most rigid abstinence from drinks of every kind.

Along with the common odour of insensible perspiration, discharged from the human surface, we often meet with other odours of a much stronger kind, produced by particular diseases or particular modes of life, and which are distinctly perceptible. Thus, the food of garlic yields a perspiration possessing a garlic smell; that of peas a leguminous smell; coarse oils and fat a rancid smell, which is the cause of this peculiar odour among the inhabitants of Greenland; and acids a smell of acidity. Among glass-blowers, from the large quantity of sea-salt that enters into the materials of their manufacture, the sweat is sometimes so highly impregnated, that the salt they employ, and imbibe by the skin and lungs, has been seen to collect in crystals upon their faces.

Hence, too, the various smells that are emitted from the surface of other animals, and especially that of musk, which is one of the most common. We trace this issuing generally from the bodies of many of the ape species, and especially the simia *Jacchus*; still more profusely from the opossum, and occasionally from hedge-hogs, water-rats, hares, serpents, and crocodiles. The odour of civet is the production of the civet-cat alone, the viverra *Zibetha*, and viverra *Civetta* of Linnéus; though we meet with faint traces of it in some varieties of the domestic cat, the felis *Catta* of the same writer. Genuine castor is, in like manner, a secretion of the castor fiber; but the sus Tajassu, and various other species of swine, yield a smell that makes an approach towards it.

Among insects, however, these odours are considerably more varied, as well as considerably more pleasant; for the musk-scent of the cerambix *moschatus*, the apis *fragrans*, and the tipula *moschifera*, is far more delicate than that of the musk quadrupeds; while the cerambix *suaveolens*, and several species of the ichneumon, yield the sweetest perfume of the rose; and the petiolated sphex a balsamic ether highly fragrant, but peculiar to itself. Yet insects, like other classes of animals, furnish instances of disagreeable, and even disgusting scents, as well as of those that are fragrant. Thus, several species of the melitæ breathe an essence of garlic or onions; the staphilinus *brunipes* has a stench intolerably fetid, though combined with the perfume of spices; while the caterpillars of almost all the hymenoptera, and the larves of various other orders, emit an exhalation in many instances excessively pungent. The carabus *crepitans*, and sclopeta of Fabricius, pour forth a similar vapour, accompanied with a strange crackling sound.

The odorous secretions belonging to the vegetable tribes are well known to be still more variable; sometimes poured forth from the leaves of the plant, as in the bay, sweet-briar, and heliotrope; sometimes from the trunk, as in the pines and junipers; but more generally from the corol. It is from the minute family of the jungermannia, nearly related to the mosses, and often scarcely visible to the eye, that we derive the chief sense of that delightful fragrance perceptible after a shower, and especially at eventide :* and from the florets of the elegant anthoxanthum *odoratum*, or spring-grass, that we are chiefly furnished with the sweet and fragrant scent of new-mown hay. But occasionally the odours thus secreted are as intolerable as any that are emitted from the animal world ; of which the ferula *assafœtida*, or assafetida plant, and the stapelia *hirsuta*, or carrion flower, are sufficient examples.

To the same secernent powers, moreover, of animals and vegetables, existing in particular organs rather than extended through the system generally, we are indebted for a variety of very valuable materials in trade and diet, as gums, resins, wax, fat, oils, spermaceti. And to the same cause we owe, also, a production of a multiplicity of poisons and other deleterious substances : such, for instance, as the poison of venomous serpents, which is found to consist of a genuine gum, and is the only gum known to be secreted by animal organs ; the electric gas of the gymnotus *electricus* and raia *Torpedo ;* the pungent sting of the stinging-nettle, urtica *urens*, and of the bee, both which are produced from a structure of a similar kind ; for every aculeus or stinging point of the nettle is a minute and highly irritable duct, that leads to a minute and highly irritable bulb, filled with a minute drop of very acrid fluid : and hence, whenever any substance presses against any of the aculei or stinging points of the plant, the impression is communicated to the bulb, which instantaneously contracts, and throws forth the minute drop of acrid fluid through the ducts upon the substance that touches them.

As the secernent system thus evidently allots particular organs for the secretion of particular materials, the absorbent system is in like manner only capable of imbibing and introducing into the general frame particular materials in particular parts of it. Thus, opium and alkohol, the juice of aconite, and essential oil of laurel or bitter almonds, produce little or no effect upon the absorbents of the skin, but a very considerable effect upon the coating of the stomach. In like manner, carbonic acid gas invigorates rather than injures, when applied to the absorbents of the stomach, but instantly destroys life when applied to those of the lungs ; while the aroma of the toxicaria *Macasariensis*, or Boa upas, of which we have heard so much of late years, proves equally a poison, whether received by the skin, the stomach, or the lungs.

So, also, substances that are poisonous to one tribe of animals are medicinal to a second, and even highly nutritive to a third. Thus, swine are poisoned by pepper-seeds, which to a man are a serviceable and grateful spice ; while henbane-roots, which destroy mankind, prove a wholesome diet to swine. In like manner, aloes, which to our own kind is a useful medicine, is a rank venom to dogs and foxes ; and the horse, which is poisoned by the phellandrum *aquaticum*, or water-hemlock, and corrosive sublimate, will take a dram of arsenic daily, and improve hereby both in his coat and condition.

It has already appeared, that the secernent vessels of any part of the system, in order to accomplish a beneficial purpose, as, for example, that of restoring a destroyed or injured portion of an organ, may change their action, and secrete a material of a new nature and character. An equal change is not unfrequently produced under a morbid habit, and the secretion will then be of a deleterious instead of being of a healthy and sanative kind. And hence, under the influence of definite causes, the origin of such mischievous and fatal secretions, in some instances thrown forth generally, and in others only from particular organs, as the matter of small-pox, measles, putrid fevers of various kinds, cancers, and hydrophobia, or the poisonous saliva of mad dogs.

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* Hooker's Monography of British Jungerm.

But the field opens before us to an unbounded extent, and we should lose ourselves in the subject if we were to proceed much farther. It is obvious, that in organic, as in inorganic nature, every thing is accurately arranged upon a principle of mutual adaptation, and regulated by an harmonious antagonism, a system of opposite yet accordant powers, that balance each other with most marvellous nicety; that increase and diminution, life and death proceed with equal pace; that foods are poisons, and poisons foods; and finally, that there is good enough in the world, if rightly improved, to make us happy in our respective stations so long as they are allotted to us, and evil enough to wean us from them by the time the grant of life is usually recalled.

LECTURE XV.

ON THE EXTERNAL SENSES OF ANIMALS.

THE subject of study for the present lecture is the organs of external sense in animals: their origin, structure, position, and powers; and the diversities they exhibit in different kinds and species.

The external senses vary in their number: in all the more perfect animals they are five; and consist in the faculties of sight, smell, hearing, taste, and touch.

It is by these conveyances that the mind or sensory receives a knowledge of whatever is passing within or without the system; and the knowledge it thus gets possession of is called perception.

The different kinds of perception, therefore, are as numerous as the different channels through which they are received, and they produce an effect upon the sensory which usually remains for a long time after the exciting cause has ceased to operate. This effect, for want of a better term, we call *impressions;* and the particular facts, or things impressed, and of which the impressions retain, as it were, the print or picture, *ideas*.

The sensory has a power of suffering this effect or these ideas to remain latent or unobserved, and of calling them into observation at its option: it is the active exercise of this power that constitutes *thought.*

The same constitution, moreover, by which the mind is enabled to take a review of any introduced impression, or to exercise its thought upon any introduced idea, empowers it to combine such impressions or ideas into every possible modification and variety. And hence arises an entirely new source of knowledge, far more exalted in its nature and infinitely more extensive in its range: hence memory and the mental passions; hence reason, judgment, consciousness, and imagination, which have been correctly and elegantly termed the *internal senses*, in contradistinction to those by which we obtain a knowledge of things exterior to the sensorial region.

Thus far we can proceed safely, and feel our way before us; but clouds and darkness hang over all beyond, and a gulf unfathomable to the plummet of mortals. Of the sensory, or mind itself, we know nothing; we have no chemical test that can reach its essence, no glasses that can trace its mode of union with the brain, no abstract principles that can determine the laws of its control. We see, however, enough to convince us that its powers are of a very different description from those of the body, and revelation informs us that its nature is so too. Let us receive the information with gratitude, and never lose sight of the duties it involves.

But this subject would lead us astray even at our outset: it is important, and it is enticing; and the very shades in which much of it is wrapped up prove an additional incitement to our curiosity. It shall form the basis of some subsequent investigation,* but our present concern is with the external senses alone.

These, for the most part, issue from the brain, which, in all the more perfect animals, is an organ approaching to an oval figure; and consists of three distinct parts: the cerebrum, or brain properly so called; the cerebel, or little brain, and the oblongated marrow. The first constitutes the largest and uppermost part; the second lies below and behind; the third, level with the second, and in front of it—it appears to issue equally out of the two other parts, and gives birth to the spinal marrow, which may hence be regarded as a continuation of the brain, extended through the whole chain of the spine or back-bone.

From this general organ arises a certain number of long, whitish, pulpy strings or bundles of fibres, capable of being divided and subdivided into minuter bundles of filaments or still smaller fibres, as far as the power of glasses can carry the eye. These strings are denominated nerves; and by their different ramifications convey different kinds or modifications of sensation to different parts of the body, keep up a perpetual communication with its remotest organs, and give activity to the muscles. They have been supposed by earlier physiologists to be tubular or hollow, and a few experiments have been tried to establish this doctrine in the present day, but none that have proved satisfactory.

As the brain consists of three general divisions, it might, at first sight, be supposed that each of them is allotted to some distinct and ascertainable purpose: as, for example, that of forming the seat of intellect, or thinking; the seat of the local senses of sight, sound, taste, and smell; and the seat of general feeling or motivity. But the experiments of anatomists upon this abstruse subject, numerous and diversified as they have been of late years, and, unhappily, upon living as well as upon dead animals, have arrived at nothing conclusive in respect to it; and have rather given rise to contending than to concurrent opinions. So that we are nearly or altogether unacquainted with the reason of this conformation, and of the respective share which each division takes in producing the general effect.

The nerves uniformly issue in pairs, one for each side of the body, and the number of pairs is thirty-nine; of which nine rise immediately from the great divisions of the brain, under which we have just contemplated it, and are chiefly appropriated to the four local senses; and thirty from the spinal marrow, through different apertures in the bone that incases it, and are altogether distributed over the body, to produce the fifth or general sense of touch and feeling, as also irritability to the muscles.

That these nervous or pulpy fibres are the organs by which the various sensations are produced or maintained is demonstrable from the following facts. If we divide, or tie, or merely compress a nerve of any kind, the muscle with which it communicates becomes almost instantly palsied; but upon untying or removing the compression the muscle recovers its feeling and mobility. If the compression be made on any particular portion of the brain, that part of the body becomes motionless which derives nerves from the portion compressed. And if the cerebrum, cerebel, or oblongated marrow be irritated, excruciating pain or convulsions, or both, take place all over the body, though chiefly where the irritation is applied to the last of these three parts.

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* Series III. Lect. I. II. III. IV.

The matter of sensation, or nervous fluid, as for want of a more precise knowledge upon this subject we must still continue to call it, is probably as homogeneous in its first formation as the fluid of the blood; but, like the blood, it appears to be changed by particular actions, either of particular parts of the brain, or of the particular nervous fibres themselves, into fluids of very different properties, and producing very different results. And it is probably in consequence of such changes alone that it is capable of exciting one set of organs to communicate to the brain the sensation of sound alone, another set that of sight alone, and so of the rest. While branches from the spinal marrow, or fountain-nerve of touch, are diffused over every portion of the body, sometimes in conjunction with the local nerves, as in the organs of local sense, and sometimes alone, as in every other part of the system.*

Such an idea leads us naturally to a very curious and recondite subject, which has never, that I know of, been attended to by physiologists, and will at the same time throw no small degree of light upon it:— I mean the production of other senses and sensorial powers that are common to the more perfect animals, or such a modification of some one of them as may give the semblance of an additional sense.

What, for example, is that wonderful power by which migratory birds and fishes are capable of steering with the precision of the expertest mariner from climate to climate, and from coast to coast; and which, if possest by man, might perhaps render superfluous the use of the magnet, and considerably infringe upon the science of logarithms? Whence comes it that the field-fare and red-wing, that pass their summers in Norway, or the wild-duck and merganser, that in like manner summer in the woods and lakes of Lapland, are able to track the pathless void of the atmosphere with the utmost nicety, and arrive at our own coasts uniformly in the beginning of October? or that the cod, the whiting, and the herring, should visit us in innumerable shoals from quarters equally remote, and with an equal exactness of calculation? the cod pursuing the whiting, which flies before it, from the banks of Newfoundland to the southern coasts of Spain; and the cachalot, or spermaceti whale, driving vast armies of herrings from the arctic regions, and devouring thousands of those that are in the rear every hour.

We know nothing of this sense, or the means by which all this is produced; and knowing nothing of it, and feeling nothing of it, we have no terms by which to reason concerning it.

Yet it is a sense not limited to migratory animals. A carrier-pigeon has been brought in a bag from Norwich to this metropolis, constituting a distance of 120 miles; and having been let off with a letter tied round its neck, from the top of St. Paul's, has returned home through the air in a straight line, in four or five hours.

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* See Hunter's Anim. Economy, p. 261, 262.

Buffon asserts, that a hawk or eagle can travel two hundred leagues in ten hours, and relates a story of one that travelled two hundred and fifty leagues in sixteen hours.

A Newfoundland dog has in like manner been brought from Plymouth to London by water, and having got loose, has run home by land with a speed so rapid as to prove that his course must have been nearly in a straight line, though every inch of it was unknown to him.

At such instances we start back, and as far as we can, we disbelieve them, and think we become wise in proportion as we become skeptical. Meanwhile nature pursues her wonder-working course, equally uninfluenced by our doubts or our convictions.*

Even among mankind, however, we occasionally meet with a sort of sensation altogether as wonderful and inexplicable. For there are some persons so peculiarly affected by the presence of a particular object, that is neither seen, smelt, tasted, heard, or touched, as not only to be conscious of its presence, but to be in agony till it is removed. The vicinity of a cat not unfrequently produces such an effect; and I have been a witness to the most decisive proofs of this in several instances. It is possible that the anomalous sense may in this instance result from a peculiar irritability in some of the nervous branches of the organ of smell, which may render them capable of being irritated in a new and peculiar manner: but the persons thus affected are no more conscious of an excitement in this organ of sense than in any other; and from the originality of the sensation itself find no terms in any language by which the sensation can be expressed.

Sharks and rays are generally supposed by naturalists to be endowed with a peculiar sense in the organ of a tubular structure found immediately under the integuments of the head, though they have not agreed as to the exact character of this additional sense. Trevannius calls it generally a sixth organ of sensation. M. Jacobson, and Dr. de Blainville, who quotes his authority, regard it as a local organ of touch. M. Roux, who seems to have examined it with great attention, believes it to be the source of a feeling of a middle nature between the two senses of touch and hearing.† The bat appears to have, in like manner, an additional sensific power, for it is observed to avoid external objects when in their vicinity, while the eye, ear, and nose are closed, and there is no direct touch: and this peculiar feeling has been called a sixth sense generally by naturalists, without discriminating it farther.

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* The fact of the migratory power of one kind of animals confirms the fact of the migratory power of others. While the question was confined to birds it was too often denied by many naturalists, merely from the difficulty of accounting for it; and it was said, in opposition to Catesby and White, and all our best ornithologists, that our summer birds only disappear by creeping into holes and crevices to hybernate. And hence, even so late as 1823, the late Dr. Jenner felt himself called upon to examine such assertions with a view of disproving them; which he has done in one of the most agreeable essays on the natural history of migratory birds to be found in our own or any other language. "A little reflection," says he, "must compel us to confess that they are endowed with discriminating powers totally unknown to, and for ever unattainable by man. I have no objection to admit the possibility that birds may be overtaken by the cold of winter, and thus be thrown into the situation of other animals which remain torpid at that season; though I must own I never witnessed the fact, nor could I ever obtain evidence on the subject that was to me satisfactory; but, as it has been often asserted, may I be allowed to suppose that some deception might have been practised with the design of misleading those to whom it might have seemed to appear obvious?" Phil. Trans. 1824. p. 11. The strongest argument against all such disbelief, arising from the difficulty of accounting for the migration of birds, is to turn to the migration of fishes, and to the parallel cases of remote travel in other animals, which are given above. The respective marvels give support to each other, till disbelief itself becomes at length the greatest marvel of the whole.

† See further on this subject, Edin. Journ. of Science, No. III. Art. III. p. 87, 1825.

What is the cause of those peculiar sensations which we denominate hunger and thirst? A thousand theories have been advanced to account for them, but all have proved equally unsatisfactory, and have died one after another almost as soon as they have received a birth. We trace indeed the organs in which they immediately reside, and know by the sensations themselves that the one exists in the region of the stomach, and the other in that of the throat: but though we call them sensations, they have neither of them any of the common characters of touch, taste, hearing, seeing, or smelling.

Foods and drinks are the natural and common means of quieting their pain, but there are other means that may be also employed for this purpose, and which are often found to answer as a temporary substitute: as, for instance, pressure against the coats of the stomach in the case of hunger, and stimulating the salivary glands in the case of thirst. It is hence that chewing a mouthful of hay alone, or merely moistened with water, proves so refreshing to a tired horse, and is found so serviceable when we dare not allow him to slake his thirst by drinking. Savages and savage beasts are equally sensible of the advantage of pressure in the case of hunger, and resort to it upon all occasions in which they cannot take off the pain in the usual way.

The manis or pangolin tribes, that swallow their food whole, will swallow stones or coals or any other substance, if they cannot obtain nutriment: not that their instinct deceives them, but for the purpose of acquiring such a pressure as may blunt the sense of hunger, which is found so corroding. Almost all carnivorous beasts pursue the same plan; and a mixture of pieces of coal, stone, slate, and earth, is often met with in the stomach of ostriches, cassowaries, and even toads. The Kamschadale obtains the same purpose by swallowing saw-dust; and some of the northern Asiatic tribes by a board placed over the region of the stomach, and tightened behind with cords, in proportion to the severity of the suffering. Even in our own country we often pursue the same end by the same means; and employ a tight handkerchief, instead of a tightened stomach-board.

In consequence of this difference in the mode in which the matter of touch or general feeling is secreted under different circumstances, we may also perceive why some parts of the body, although perhaps as largely furnished with the nerves of touch or general feeling as other parts, are far less sensible and irritable; as the bones, the teeth, and the tendons; and why the very same parts should, under other circumstances, as when morbidly affected, become the most sensible or irritable of all the organs of the system; a fact well known to all, but I believe not hitherto satisfactorily accounted for by any one.

We may also see why inflammation, attacking different organs of the body, should be accompanied with very different sensations. In the bones and cartilages, except in extreme cases, it is accompanied with a dull and heavy pain; in the brain, with an oppressive and stupifying pain; and in the stomach, with a nauseating uneasiness. So, again, in the skin, muscles, and cellular membrane, it is a pain that rouses and excites the system generally; but in those parts which are supplied with the two branches of nerves which are called par vagum and sympathetic, as the loins and kidneys, the patient is affected with lowness of spirits from the first attack of the inflammation.*

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* Hunter on Blood, p. 289, 290.

Dr. Gall, whose physiological theory has excited so much attention of late years on the Continent, has endeavoured to account for all these varieties of feeling, and, indeed, for all the animal senses of every kind, both external and internal, by supposing some particular part of the brain to be allotted to each, and that the general character and temperament of the individual is the result of the different proportions which these different parts or chambers of the brain bear to one another. He supposes, also, that this organ is possessed of two distinct sets of nervous fibres—a secernent and an absorbent: both directly connected with what is called the cineritious or ash-coloured part of the brain; the former issuing from it and secreting the fluid of the will, or that by which the mind operates on the muscles; and the latter terminating in it, and conveying to it the fluid of the external senses, secreted by those senses themselves, and communicating a knowledge of the presence and degree of power of external objects. This elaborate theory, and the facts to which it appeals, were very minutely investigated a few years ago by a very excellent committee of the physical class of the French National Institute, assisted by Mr. (now Dr.) Spurzheim, the intimate friend and coadjutor of its inventor, and who is well known to have contributed quite as much to the establishment of this speculation as himself. This committee, after a very minute and cautious research, gave it as a part of their report, that the doctrine of the origin and action of the nerves is probably correct; but that this doctrine does not appear to have any immediate or necessary connexion with that part of Dr. Gall's theory which relates to distinct functions possessed by distinct parts of the brain.* The origin, and distribution, and action, however, of the nervous trunks have since been far more accurately traced out by Mr. Charles Bell, M. Magendie, and various other physiologists; while, in refutation of the doctrine that ascribes distinct functions to distinct parts of the brain, it may be sufficient to observe, for the present, that many of the nerves productive of different functions originate in the same part, while others, productive of the same function, originate in different parts.

There is no animal whose brain is a precise counterpart to that of man; and it has hence been conceived, that by attending to the distinctions between the human brain and that of other animals, we might be able to account for their different degrees of intelligence. But the varieties are so numerous, and the parts which are deficient in one animal are found connected with such new combinations, modifications, and deficiences in others, that it is impossible for us to avail ourselves of any such diversities. Aristotle endeavoured to establish a distinction by laying it down as a maxim that man has the largest brain of all animals in proportion to the size of his body; a maxim which has been almost universally received from his own time to the present period. But it has of late years, and upon a more extensive cultivation of comparative anatomy, been found to fail in various instances: for while the brain of several species of the ape kind bears as large a proportion to the body as that of man, the brain of several kinds of birds bears a proportion still larger. M. Sömmering has carried the comparison through a great diversity of genera and species; but the following brief table will be sufficient for the present purpose. The weight of the brain to that of the body, forms—

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* For an examination of the general subject of craniology and physiognomy, see Ser. III. Lect. XIII.

In man, from	$\frac{1}{22}$ to $\frac{1}{33}$	part.
— several tribes of simia	$\frac{1}{22}$	—
— dog - -	$\frac{1}{101}$	—
— elephant - -	$\frac{1}{500}$	—
— sparrow -	$\frac{1}{25}$	—
— canary bird -	$\frac{1}{14}$	—
— goose - -	$\frac{1}{360}$	—
— turtle (smallest) -	$\frac{1}{5688}$	—

M. Sömmering has hence endeavoured to correct the rule of Aristotle by a modification, under which it appears to hold universally; and thus corrected, it runs as follows: " Man has the largest brain of all animals in proportion to the general mass of nerves that issue from it."

Thus, the brain of the horse gives only half the weight of that of a man, but the nerves it sends forth are ten times as bulky. The largest brain which M. Sömmering ever dissected in the horse tribe weighed only 1lb. 4oz. while the smallest he ever met with in an adult man was 2lb. 5½oz.*

It is a singular circumstance, that in the small heart-shaped pulpy substance of the human brain, denominated the pineal gland, and which Descartes regarded as the seat of the soul, a collection of sandy matter should invariably be found after the first few years of existence; and it is still more singular that such matter has rarely, if ever, been detected but in the brain of a few bisculated animals, as that of the fallow-deer, in which it has been found by Sömmering;† and that of the goat, in which it has been traced by Malacarne.‡

The nervous system of all the vertebral or first four classes of animals, —mammals, birds, amphibials, and fishes,—are characterized by the two following properties:—first, the organ of sense consists of a gland or ganglion, with a long and bifid chord or spinal marrow descending from it, of a smaller diameter than the gland itself; and, secondly, both are severally enclosed in a bony case or covering.

In man, as we have already observed, this gland, or ganglion, is (with a few exceptions) larger than in any other animal, in proportion to the size of the body; without any exception whatever in proportion to the size of the chord or spinal marrow that issues from it.

In other animals, even of the vertebral classes, or those immediately before us, we meet with every variety of proportion; from the ape, which, in this respect, approaches nearest to that of man, to tortoises and fishes, in which the brain or ganglion does not much exceed the diameter of the spinal marrow itself.

It is not therefore to be wondered at that animals of a still lower description should exhibit proofs of a nervous chord or spinal marrow, without a superior gland or brain of any kind; and that this chord should even be destitute of its common bony defence. And such is actually the conformation of the nervous system in insects, and, for the most part, in worms; neither of which are possessed of a cranium or spine, and in none of which we are able to trace more than a slight enlargement of the superior part of the nervous chord or spinal marrow, as it is called in other animals—a part situated near the mouth, and apparently intended to correspond with the organ of a brain. The nervous chord, however, in these animals is, for the most part, proportionally larger than in those of a superior rank; and at various distances is possessed of little knots or ganglions, from which fresh ramifications of nerves shoot forth, like branches from the trunk of a tree, and which may perhaps be regarded as so many distinct cerebels or little brains.

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* Stud. of Med. iv. 11. 2d edit.

† Dissertatio de basi Encephali, 1778; and Tabula baseos Encephali, 1799. See Blumenb. p. 292.

‡ Dissert. p. 10. See also Blumebach, Anat. Comp. § 206.

In zoophytic worms, we can scarcely trace any distinction of structure, and are totally unable to recognise a nervous system of any kind. The common and almost transparent hydra or polype, which is often to be found in the stagnant waters of our own country, with a body about an inch long, and arms or tentacles in proportion, appears to consist, when examined by the best glasses, of nothing but a granular structure, something like boiled sago, connected by a gelatinous substance into a definite form.* Hydatids and infusory animals exhibit a similarity of make. The common formative principle of all these may be reasonably conjectured to consist in the living power of the blood alone, or rather of the fluid which answers the purpose of blood; and their principles of action to be little more than instinctive.

Can we, then, conceive that all these different kinds, and orders, and classes of animals, thus differently organized and differently endowed with intelligence, are possessed of an equality of corporeal feeling? or, to adopt the language of the poet, that—

> ———the poor worm thou tread'st on,
> In corporeal suffering, feels a pang as great
> As when a giant dies?

This is an interesting question, and deserves to be examined at some length. It may, perhaps, save the heart of genuine sensibility from a few of those pangs which, even under the happiest circumstances of life, will be still called forth too frequently; and if there be a human being so hardened and barbarized as to take advantage of the conclusion to which the inquiry may lead us, he will furnish an additional proof of its correctness in his own person, and show himself utterly unqualified for the discussion.

Life and sensation, then, are by no means necessarily connected: the blood is alive, but we all know it has no sensation; and vegetables are alive, but we have no reason to suppose they possess any. Sensation, so far as we are able to trace it, is the sole result of a nervous structure. Yet, though thus limited, it has already appeared that it does not exist equally in every kind of the same structure, nor in every part of the same kind. The skin is more sensible to pain than the lungs, the brain, or the stomach; but even the skin itself is more sensible in some parts than in others, which are apparently supplied with an equal number of nerves, and of nerves from the very same quarter. It is perhaps least sensible in the gums; a little more so on the hairy scalp of the head; much more so on the front of the body, and most of all so in the interior of the eyelids: while the bones, teeth, cartilages, cuticle, and cellular membrane, though largely supplied with nerves, have no sensation whatever in a healthy state.

As the degree of intelligence decreases, we have reason to believe that the intensity of touch or corporeal feeling decreases also, excepting in particular organs, in which the sense of touch is employed as a local power. And hence we may reasonably conjecture that in some of the lowest ranks of animals, the sensibility may not exceed, even in their most lively organs, the acuteness of the human cellular membrane, cuticle, or gums.

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* Blumenb. Anat. Comp. § 208.

This, however, does not rest upon conjecture, or even upon loose indefinite reasoning. We find in our own system that those parts which are most independent of all the other parts, and can reproduce themselves most readily, are possessed of the smallest portion of sensation ; such are all the appendages of the true skin, the cuticle, horn, hair, beard, and nails ; some of which are so totally independent of the rest, that they will not only continue to live, but even to grow, for a long time after the death of every other part of the body.

Now it is this very property by which every kind of animal below the rank of man is in a greater or less degree distinguished from man himself. All of them are compounded of organs which in a greater or less degree approach towards that independence of the general system which, in man, the insensible or less sensible parts alone possess : and hence all of them are capable of reproducing parts that have been destroyed by accident or disease, with vastly more facility and perfection than mankind can do.

I have once or twice had occasion to apply this remark to the lobster, which has a power not only of reproducing its claws spontaneously, when deprived of them by accident or disease, but of throwing them off spontaneously, whenever laid hold of by them, in order to extricate itself from the imprisoning grasp. The tipula *pectiniformis*, or insect vulgarly called father-long-legs, and several of the spider family, are possessed of a similar power, and exercise it in a similar manner. These limbs are renewed by the formative effect of the living principle in a short period of time : but it would be absurd to imagine that in thus voluntarily parting with them the animal puts himself to any very intolerable degree of pain ; for, in such case, he would not exert himself to throw them off. The gadfly, when it has once fastened on the hand, may be cut to pieces apparently without much disturbance of its gratification ; and the polype appears to be in as perfect health and contentment when turned inside out as when in its natural state. This animal may be divided into halves, and each half, by its own formative and instinctive effort, will produce the half that is deficient, and in this manner an individual of the tribe may be multiplied into countless numbers.

In many animals of the three classes of amphibials, insects, and worms, the most dreadful wounds that can be inflicted, unless actually mortal, seem hardly to accelerate death : and hence we have a decisive proof that the pain endured by such animals must be very considerably and almost infinitely less than would be suffered by animals of a more perfect kind, and especially by man ; since in these the pain itself, and the sympathetic fever which follows as its necessary result, would be sufficient to kill them independently of any other cause.

The life of man is in jeopardy upon the fracture or amputation of a limb ; and even at times when his body has been spattered over with a charge of small shot, or only of gunpowder. But M. Ribaud, with a spirit of experimenting that I will not justify, had stuck different beetles through with pins, and cut and lacerated others in the severest manner, all of which lived through their usual term of life as though no injury had been committed on them. Vaillant wishing to preserve a locust of the

Cape of Good Hope, took out the intestines, and filled the abdomen with cotton, and then fixed it down by a pin through the chest; yet after five months the animal still moved its feet and antennas.

In the beginning of November Redi opened the skull of a land tortoise, and excavated it of the whole brain. He expressly tells us that the tortoise did not seem to suffer: it moved about as before, but groped for its path, for the eyes closed soon after losing the brain, and never opened again. A fleshy integument was produced, which covered the opening of the skull, but the instinctive power of the living principle was incompetent to renew the brain, and in the ensuing May, six months afterwards, the animal died.*

Spalanzani has incontestibly proved that the snail has the power of reproducing a new head when decapitated: but it should be remarked that the brain of the snail does not exist in its head.

I will not pursue this argument any farther; it is in many respects painful and abhorrent; and consists of experiments in which I never have been, and trust I never shall be, a participant. But I avail myself of the facts themselves in order to establish an important conclusion in physiology, which I could not so well have established without them.

Let us turn to a more cheerful subject, and examine a few of those peculiarities in the external senses which characterize the different classes and orders of animals, so far as we are acquainted with such distinctions; and admire the wisdom which they display.

The only sense which seems common to animals, and which pervades almost the whole surface of their bodies, is that of general touch or feeling, whence M. Cuvier supposes that the material of touch is the sensorial power in its simplest and uncompounded state; and that the other senses are only modifications of this material, though peculiarly elaborated by peculiar organs, which are also capable of receiving more delicate impressions.† Touch, however, has its peculiar local organ, as well as the other senses, for particular purposes, and purposes in which unusual delicacy and precision are required; in man this peculiar power of touch is well known to be seated in the nervous papillæ of the tongue, lips, and extremities of the fingers. Its situation in other animals I shall advert to presently.

The differences in the external senses of the different orders and kinds of animals consist in their number and degree of energy.

All the classes of vertebral animals possess the same number of senses as man. Sight is wanting in zoophytes, in various kinds of molluscous and articulated worms, and in the larves of several species of insects. Hearing does not exist, or at least has not been traced to exist, in many molluscous worms and several insects in a perfect state. Taste and smell, like the general and simple sense of touch, seem seldom to be wanting in any animal.

The local sense of TOUCH, however, or that which is of a more elaborate character and capable of being exercised in a higher degree, appears to be confined to the three classes of mammals, birds, and insects: and even in the last two it is by no means common to all of them, and less so among insects than among birds.

In apes and macaucoes, constituting the quadrumana of Blumenbach, it resides partly in the tongue, and tips of the fingers, as in man, but equally, and in some species even in a superior degree, in their toes. In the racoon (ursus *lotor*) it exists chiefly in the under surface of the front toes. In the horse and cattle orders, it is supposed by most naturalists to exist conjointly in the tongue and snout, and in the pig and mole to be confined to the snout alone : this however is uncertain ; as it is also, though there seems to be more reason for such a belief, that in the elephant it is seated in the proboscis. Some physiologists have supposed the bristly hairs of the tiger, lion, and cat, to be an organ of the same kind ; but there seems little ground for such an opinion. In the opossum (and especially the Cayenne opossum) it exists very visibly in the tail ; and M. Cuvier suspects that it has a similar existence in all the prehensile-tailed mammals.

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* Dalzell's Introd. to his Transl. of Spalanzani, p. xlv.

§ Anatom. Comparat. i. 25.

Blumenbach supposes the same sense to have a place in the same organ in the platypus or ornithorhynchus as he calls it, that most extraordinary duck-billed quadruped which has lately been discovered in Australia, and, by its intermixture of organs, confounds the different classes of animals, and sets all natural arrangement at defiance.

The local organ of touch or feeling in ducks and geese, and some other genera of birds, appears to be situated in the integument which covers the extremity of the mandibles, and especially the upper mandible, with which apparatus they are well known to feel for their food in the midst of mud in which they can neither see nor perhaps smell it.

We do not know that amphibials, fishes, or worms possess any thing like a local sense of touch ; it has been suspected in some of these, and especially in the arms of the cuttle-fish, and in the tentacles of worms that possess this organ, but at present it is suspicion and nothing more.

In the insect tribes, we have much reason for believing such a sense to reside in the antennas, or in the tentacles ; whence the former of these are denominated by the German naturalists *fühlhorner* or feeling-horns. This belief has not been fully established, but it is highly plausible, from the general possession of the one or the other of these organs by the insect tribes, the general purpose to which they apply them, and the necessity which there seems for some such organ from the crustaceous or horny texture of their external coat.

The senses of TASTE and SMELL in animals bear a very near affinity to the local sense of touch ; and it is difficult to determine whether the upper mandible of the duck tribe, with which they distinguish food in the mud, may not be an organ of taste or smell as well as of touch ; and there are some naturalists that in like manner regard the cirrous filaments or antennules attached to the mouths of insects as organs of taste and touch equally. Taste in the more perfect animals resides jointly in the papillæ of the tongue and the palate ; but I have already had occasion to observe that it may exist, and in full perfection, in the palate alone, since it has been found so in persons who have completely lost the tongue from external force or disease.

In animals that possess the organ of nostrils this is always the seat of smell ; and in many quadrupeds, most birds, and perhaps most fishes, it is a sense far more acute than in man, and that which is chiefly confided in. For the most part it resides in the nerves distributed over a mucous membrane that lines the interior of the bones of the nostrils, and which is called the Schneiderian membrane, in honour of M. Schneider, a celebrated anatomist, who first accurately described it. Generally speaking, it will be found that the acuteness of smell bears a proportion in all animals to the extent of surface which this membrane displays; and hence, in the dog and cattle tribes, as well as in several others, it possesses a variety of folds or convolutions, and in birds is continued to the utmost points of the nostrils, which in different kinds open in very different parts of the mandible.

The frontal sinuses, which are lined with this delicate membrane, are larger in the elephant than in any other quadruped, and in this animal the sense is also continued through the flexible organ of its proboscis. In the pig the smelling organ is likewise very extensive: and in most of the mammals possessing proper horns it ascends as high as the processes of the frontal bone from which the horns issue.

It is not known that the cetaceous tribes possess any organ of smell; their blowing-holes are generally regarded as such; but the point has been by no means fully established. We are in the same uncertainty in respect to amphibials and worms; the sense is suspected to exist in all the former, and in several of the latter, especially in the cuttle-fish, but no distinct organ has hitherto been traced out satisfactorily.

In fishes there is no doubt; the olfactory nerves are very obviously distributed on an olfactory membrane, and in several instances the snouts are double, and consequently the nostrils quadruple, a pair for each snout. This powerful inlet of pleasure to fishes often proves fatal to them from its very perfection; for several kinds are so strongly allured by the odour of marjorum, assafœtida, and other aromas, that by smearing the hand over with these substances, and immersing it in the water, they will often flock towards the fingers, and in their intoxication of delight may easily be laid hold of. And hence the angler frequently overspreads his baits with the same substances, and thus arms himself with a double decoy.

There can be no doubt of the existence of the same sense in insects, for they possess a very obvious power of distinguishing the odorous properties of bodies, even at a considerable distance beyond the range of their vision: but the organ in which this sense resides has not been satisfactorily pointed out; Reimar supposes it to exist in their stigmata, and Knoch in their anterior pair of feelers.

The general organ of HEARING is the ear, but not always so; for in most of those who hear by the Eustachian tube only, it is the mouth, and in the whale tribes the nostrils or blow-hole. It is so, however, in all the more perfect animals, which usually for this purpose possess two distinct entrances into the organ, a larger and external, surrounded by a lobe; and a smaller and internal, opening into the mouth. It is this last which is denominated the Eustachian tube. The shape of the lobe is seldom found even in mammals similar to that in man, excepting among the monkey and the porcupine tribes. In many kinds there is neither external lobe nor external passage. Thus, in the frog, and most amphibious animals, the only entrance is the internal, or that from the mouth; and in the cetaceous tribes the only effective entrance is probably of the same kind; for, though these may be said to possess an external aperture, it is almost imperceptibly minute. It is a curious fact, that, among the serpents, the blind-worm or common harmless snake is the only species that appears to possess an aperture of either sort; the rest have a rudiment of the organ within, but we are not acquainted with its being pervious to sound.

Fishes are well known to possess a hearing organ, and the skate and shark have the rudiment of an external ear; but, like other fishes, they seem chiefly to receive sound by the internal tubule alone.

That insects in general hear is unquestionable, but it is highly questionable by what organ they obtain the sense of hearing. The antennas, and perhaps merely because we do not know their exact use, have been supposed by many naturalists to furnish the means; it appears fatal, however, to this opinion to observe, that spiders hear though they have no true antennas, and that other insects which possess them naturally seem to hear as correctly after they are cut off.

The sense of VISION exhibits perhaps more variety in the different classes of animals than any of the external senses. In man, and the greater number of quadrupeds, it is guarded by an upper and lower eye-lid; both of which in man, but neither of which in most quadrupeds, are terminated by the additional defence and ornament of cilia or eye-lashes. In the elephant, opossum, seal, cat kind, and various other mammals, all birds, and all fishes, we find a third eye-lid, or nictitating membrane, as it is usually called, arising from the internal angle of the eye, and capable of covering the pupil with a thin transparent veil, either wholly or in part, and hence of defending the eyes from danger in their search after food. In the dog this membrane is narrow; in oxen and horses it will extend over half the eye-ball; in birds it will easily cover the whole; and it is by means of this veil, according to Cuvier, that the eagle is capable of looking directly against the noon-day sun. In fishes it is almost always upon the stretch, as in their uncertain element they are exposed to more dangers than any other animal. Serpents have neither this nor any other eye-lid: nor any kind of external defence whatever but the common integument of the skin.

The largest eyes in proportion to the size of the animal belong to the bird tribes, and nearly the smallest to the whale; the smallest altogether to the shrew and mole; in the latter of which the eye is not larger than a pin's head.

The iris, with but few exceptions, partakes of the colour of the hair, and is hence perpetually varying in different species of the same genus. The pupil exhibits a very considerable, though not an equal variety in its shape. In man it is circular; in the lion, tiger, and indeed all the cat kind, it is oblong; transverse in the horse and in ruminating animals; and heart-shaped in the dolphin.

In man, and the monkey tribes, the eyes are placed directly under the forehead; in other mammals, birds, and reptiles, more or less laterally; in some fishes, as the genus pleuronectes, including the turbot and flounder tribes, both eyes are placed on the same side of the head; in the snail they are situated on its horns, if the black points on the extremities of the horns of this worm be real eyes, of which, however, there is some doubt: in spiders the eyes are distributed over different parts of the body, and in different arrangements, usually eight in number, and never less than six. The eyes of the sepia have lately been detected by M. Cuvier; their construction is very beautiful, and nearly as complicated as that of vertebrated animals.* Polypes and several other zoophytes appear sensible of the presence of light, and yet have no eyes; as the nostrils are not in every animal necessary to the sense of smell, the tongue to that of taste, or the ears to that of sound. A distinct organ is not always requisite for a distinct sense. In man himself we have already seen this in regard to the sense of touch, which exists both locally and generally; the distinct organ of touch is the tips of the tongue and of the fingers, but the feeling is also diffused, though in a subordinate and less precise degree, over every part of the body. It is possible, therefore, in animals that appear endowed with particular senses without particular organs for their residence, that these senses are diffused, like that of touch, over the surface generally; though there can be no doubt, that, for want of such appropriate organs, they must be less acute and precise than in animals that possess them.*

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* Le Regne Animale distribue d'apres son Organization, 4 tomes, 8vo. Paris 1817.

But who of us can say what is possible? who of us can say what has actually been done? After all the assiduity with which this attractive science has been studied, from the time of Aristotle to that of Lucretius, or of Pliny, and from these periods to the present day,—after all the wonderful and important discoveries which have been developed in it, natural history is even yet but little more than in its infancy, and zoonomy is scarcely entitled to the name of a science in any sense. New varieties and species, and even kinds of beings, are still arising to our view among animals, among vegetables, among minerals:—new structures are detecting in those already known, and new laws in the application of their respective powers.

But the globe has been upturned from its foundation; and with the wreck of a great part of its substance has intermingled the wreck of a great part of its inhabitants. It is a most extraordinary fact, that of the five or six distinct layers or strata of which the solid crust of the earth is found to consist, so far as it has ever been dug into, the lowermost or granitic, as we observed on a former occasion,† contains not a particle of animal or vegetable materials of any kind; the second, or transition formation, as Werner has denominated it, is filled, indeed, with fossil relics of animals, but of animals not one of which is to be traced in a living state in the present day; and it is not till we ascend to the third, or floetz stratification, that we meet with a single organic remain of known animal structures.

M. Cuvier has been engaged for the last fifteen years in forming a classification, and establishing a museum of nondescript animal fossils, for the purpose of deciding, as far as may be, the general nature and proportion of those tribes that are now lost to the world: and in the department of quadrupeds alone, his collection of unknown species amounted in the year 1810 to not less than seventy-eight, some of which he has been obliged to arrange under new genera, as we shall have occasion to notice still further in a subsequent study. In the new and untried soil of America, the bones of unknown kinds and species lie buried in profusion; and my late friend, Professor Barton, of Philadelphia, one of our first transatlantic physiologists, informed me by letter a short time before his death, that they are perpetually turning up skeletons of this description, whose living representatives are no where to be met with.

In few words, every region has been enriched with wonders of animal life that have long been extinct for ever. Where is now that enormous mammoth, whose bulk outrivalled the elephant's?‡ where that gigantic tapir, of a structure nearly as mountainous,‡ whose huge skeleton has been found in a fossil state in France and Germany; while its only living type, a pigmy of what has departed, exists in the wilds of America? where is now the breathing form of the fossil sloth of America, the magalonix of Cuvier, whose size meted that of the ox?‡ where the mighty monitor,‡ outstripping the lengthened bulk of the crocodile? itself too, a lord of the ocean, and yet, whose only relics have been traced in the quarries of Maestricht; to which, as to another leviathan, we may well apply the forcible description of the Book of Job, "at whose appearing the mighty were afraid, and who made the deep to boil as a cauldron: who esteemed iron as straw, and brass as rotten wood; who had not his like upon the earth, and was a king amidst the children of pride."*

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* Stud. of Med. Vol. iv. p. 14. edit. 2d, 1825. † Ser. I. Lect. VI. p. 61.
‡ Ser. II. Lect. II.

Over this recondite and bewildering subject skeptics have laughed and critics have puzzled themselves; it is natural history alone that can find us a clue to the labyrinth, that enables us to repose faith in the records of antiquity, and that establishes the important position, that the extravagance of a description is no argument against the truth of a description, and that it is somewhat too much to deny that a thing has existed formerly, for the mere reason that it does not exist now.

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* Job xli. 25. 27. 31. 33, 34.

SERIES II.

LECTURE I.

ON ZOOLOGICAL SYSTEMS, AND THE DISTINCTIVE CHARACTERS OF ANIMALS.

While every department of nature displays an unbounded scope to the contemplative mind,—a something on which it may perpetually dwell with new and growing delight, and new and growing improvement; we behold in the great division of the animal kingdom a combination of allurements that draw us, and fix us, and fascinate us with a sort of paramount and magical captivity, unknown to either of the other branches of natural history; and which seem to render them chiefly or alone desirable and interesting, in proportion as they relate to animal life. There is, indeed, in the mineral domain, an awe, and a grandeur, and a majesty, irresistibly impressive and sublime; and that cannot fail to lift up the heart to an acknowledgment of the mighty power which piled the massy cliffs upon each other, and rent the mountains asunder, and flung their scattered fragments over the valleys. There is in the realm of vegetables an immeasurable profusion of bounty and of beauty, of every thing that can delight the external eye, and gratify the desire; simple, splendid, variegated, exquisite. But the moment we open the gates of the animal kingdom a new world pours upon us, and a new train of affections take possession of the bosom; it is here, for the first time, that we behold the nice lineaments of feeling, motion, spontaneity; we associate and sympathize with every thing around us, we insensibly acknowledge an approximation (often indeed very remote, but an approximation nevertheless,) to our own nature, and run over with avidity the vast volume that lies before us, of tastes, and customs, and manners, and propensities, and passions, and consummate instincts.

But where shall we commence the perusal of this volume? the different pages of which, though each intrinsically interesting, lie scattered, like the sibyl leaves of antiquity, over every part of the globe, and require to be collected and arranged in order, to give us a just idea of their relative excellence, and to enable us to contemplate them as a whole.

The difficulty has been felt in all ages; and hence multiplied classifications, or schemes for assorting, and grouping into similar divisions, such individuals as indicate a similar structure, or similar habits, or similar powers, have been devised in different periods of the world, and especially in modern times, in which the study of zoology has been pursued with a searching spirit, unknown to the sages of antiquity.—And well has it deserved to be so pursued. "This subject," observes M. Biberg, "is of so much importance, and of such an extent, that if the ablest men were to attempt to treat it thoroughly, an age would pass away before they could explain completely the admirable economy, habits, and structure even of the most imperceptible insect. There is not a single species, that does not, of itself, deserve an historian."*

Before we gird ourselves then to a critical indagation into any particular part of the immense theatre which this study presents to us, it may be convenient to contemplate it upon that general survey which it is the object of such schemes or classifications to lay down; to travel over it and mark its more prominent characters by a map, anterior to our entering upon the country itself. And such are the humble pretensions of the present lecture; which will merely attempt to place before you a brief sketch of zoology, in regard to its bare outlines; for such a sketch is the whole that our time will allow; yet if it be found faithful, it will assuredly be found beneficial; for if the outlines be correctly laid down, the picture may be filled up at our leisure.

That most sublime and magnificent of all poems, ancient or modern, the book of Job, establishes, in the most satisfactory manner, that the study of natural history, and especially the history of the animal kingdom, was cultivated at a very early period of the world,—in all probability as early, at least, as the Mosaic epoch,—with a considerable degree of minute attention in regard to various kinds and species; and the detailed references to the habits and manners of other animals that lie scattered through almost every part of the Hebrew scriptures, and especially through the book of Psalms, and those of the Prophecies, and the distinct historical notice which is given of the scientific acquaintance of Solomon with this attractive study,† establish, not only that it was attended to at a very early period, but, that it was a very favourite and fashionable pursuit for many ages throughout Egypt, Syria, and Arabia. But the first physiologist who we can say, with any degree of certainty, pointed out the expediency of a methodical arrangement of animals was Aristotle. His works upon this subject have reached us; yet, while they prove that he took the same extensive and scientific view of it which he did of all other subjects, to which he directed the wonderful powers of his comprehensive mind, they prove also, that the study of natural history in Greece, had by no means, in his day, kept pace with a variety of other studies; and that he did not conceive, aided as he was by all the mighty patronage of Alexander the Great, and the concurrent exertions of every other physiologist, that he was in possession of a sufficiency of facts to attempt the same kind of systematic arrangement here, which he is so celebrated for having effected almost everywhere else. He modestly contented himself therefore with pointing out the important use of such an arrangement as soon as it could be accomplished, and with suggesting a few hints as to the principles upon which it should be constructed. He observes that the distinctive characters of animals might be taken from the nature of their food, from their actions, their manners, or their different structures. That their inhabiting land or water, offers a distinction of another sort: and that of land animals, there are some kinds that respire by lungs, as quadrupeds, and others that have no such kind of respiration; that some are winged, and others wingless; that some possess proper blood, while others are exsanguineous; that some produce their young by eggs, and these he named oviparous, while others bring them forth naked, and these he called viviparous; that quadrupeds, again may, perhaps, be distinguished by the make of the foot, as being of three kinds, undivided, cloven, and digitated, or severed into toes or claws.*

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* Amœnitates Academicæ Suecicæ, vol. ii. art. 19. Oeconomia Naturæ.

† 1 Kings iv. 33.

These indeed were mere hints, and only intended as such; but they were truly valuable and important; for they roused zoologists to that general comparison of animal with animal, which could not fail of very essentially advancing the cause of natural history; and have, in different degrees, laid the foundation of almost every methodical arrangement which has since been offered to the world.

To run over a list of these arrangements would be equally useless and jejune. The writers who have chiefly signalized themselves in this department, are Gesner, Aldrovandi, Johnston, Ray, Linnéus, Klein, Lacépéde, Blumenbach, and Cuvier; and in particular sections of it, Lamarck, Bloch, Fabricius, Latreille, and Brogniart; all of whom have flourished since the middle of the sixteenth century; most of whom have contributed something of importance to a scientific method of studying and distributing animals; and the most celebrated of whom are Ray, Linnéus, and Cuvier.

The system of Ray is derived, in its first outlines, from that recommendation of Aristotle, which suggests an attention to the different structures of different descriptions of animal life; and his observation that one of these differences consists in their possessing lungs and sanguineous systems, or their being destitute of lungs and exsanguineous.

The Linnéan method is, for the most part, built upon this general arrangement of Mr. Ray, especially in regard to quadrupeds; it is, however, an extension of it, and certainly an improvement. That of M. Cuvier, in its subordinate division, is founded upon both these; but in its primary and leading distinctions, upon the nervous or sensorial, instead of upon the respiratory and sanguineous system; all animals upon M. Cuvier's scheme, being primarily divided into vertebrated and invertebrated; those furnished with a back-bone, or vertebral chain, for the purpose of enclosing the spinal marrow, and those destitute of such a chain: the secondary sections, consisting of vertebrated animals with warm blood, and vertebrated animals with cold blood; invertebrated animals with blood-vessels, and invertebrated animals without blood-vessels.

All these, under his last modification, which is that subjoined to his lectures on Comparative Anatomy,† are regarded as embracing nine distinct classes; as I. MAMMALS, and II. BIRDS, which belong to the warm-blooded vertebral division. III. AMPHIBIALS; and IV. FISHES, which belong to the cold-blooded vertebral division; and the five following, which fill up the division of invertebral animals. V. MOLLUSCOUS; soft-bodied marine animals, or mostly marine animals, as oysters; limpets; whelks; cuttle-fish: pipe-worms or ship-worms; defended by a testaceous covering. VI. CRUSTACEOUS; as crabs; various lobsters; shrimps; sea-spiders; and the monoculus tribes. VII. INSECTS; being all those ordinarily so denominated. VIII. WORMS, embracing along with those commonly so called, leeches, and various sea-worms with bristles on the sides of the body, as aphrodites, terebels or naked ship-worms, serpules, amphitrites, nereids, tooth-shells. IX. ZOOPHYTES: the term being used very extensively, so as to include, not only all the zoophytes or plant-like animals of Linnéus and other naturalists, but all their infusory, wheel, or microscopic animals;

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* Arist. Hist. Anim. lib. i. cap. 1. cap. 3. cap. 6.

† Lecons d'Anatomie Comparee de G. Cuvier. 8vo. 4 tom. Paris, 1805.

their medusas or sea-nettles, actinias or anemonies, and other efflorescent worms, urchins, and star-fishes; and thus largely infringing on the molluscous order of prior arrangements.

Many of these classes have inferior sections and subsections, under which the genera that appertain to them are respectively marshalled. But in a general outline it is not necessary to follow up the arrangement more minutely.

The common classification of zoological writers of the present day, is still that of Linnéus; and as such, it is that which I shall regularly follow up in the remainder of the present study, as being best adapted to popular purposes. It is probable, however, that the classification of Cuvier will ultimately take the lead of it; it is somewhat more abstruse, but considerably more definite; and offers a noble specimen of scientific ingenuity, applied to one of the noblest branches of scientific study; and I shall hence advert to this classification as we proceed, for a comparison with that of the justly celebrated Swedish naturalist.

The Linnéan system of zoology divides all animals into six classes, and each class into a definite number of orders; every order consisting of an indefinite number of kinds of genera; and every kind or genus of an indefinite number of species: the individuals in each species being perhaps innumerable.

The six classes are as follows: I. mammals, or suckling animals; II. birds; III. amphibials; IV. fishes; V. insects; VI. worms.

These may be contemplated either in an ascending or a descending scale. As we have begun with brute matter, and have progressively pursued it from a shapeless mass to mineral crystallization; from mineral crystallization to vegetable organization, and from vegetable organization to animal spontaneity; it will be most congruous still to continue in the same direction, and to commence with the lowest class constituting the worm tribes.

I. Worms, in the Linnéan vocabulary, is a term of far more extensive import than in its popular signification; and the reason of this we shall perceive as we proceed. They include all animals below the rank of insects, and are classically characterized, as being mostly without distinct head and without feet; the most prominent organs being their tentacles or feelers. The class is divided into FIVE ORDERS; intestinal, molluscous, testaceous, zoophytic, and infusory.

The FIRST ORDER OR INTESTINAL, with a few exceptions which are found in the waters, consists of animals that are uniformly traced in the bowels of the earth, or of other animals; whence, indeed, their ordinal name. They are ordinarily characterized as being simple, naked animals, without limbs. I shall instance as examples of it, the ascaris, which is found so frequently in the intestinal tube of mankind, in the species of maw or thread-worm, and round-worm: the tænia, which comprises among many others the two species of tape-worm and hydatid; and the filaria or Guinea-worm, which inhabits both the Indies, and is frequent in the morning dew; at which time it winds unperceived into the naked feet of slaves, or other menials, and creates the most troublesome itchings, frequently accompanied with inflammation and fever. The only method of extracting it is to draw it out cautiously by means of a piece of silk tied round its head as it peeps from the inflamed surface; for if, in consequence of too much straining, the animal should break, the part remaining under the skin will still survive, grow with redoubled vigour, and occasionally augment the local inflam mation to such an extent as to prove fatal. It is often twelve feet long, though not larger in diameter than a horse-hair.

The next intestinal worm at which it is worth while to throw a glance as we pass on, is the fasciola or fluke, principally known from one of its species being found in large abundance in the liver of sheep during the disease called the rot, but whether the cause or the result of this disease, has never yet been sufficiently ascertained. There are other species of this animal found in the stomach, intestines, or liver of various other animals, and occasionally of man himself. The fasciola is hermaphrodite and oviparous.

The gordius or hair-worm is chiefly worthy of notice as being supposed, in one of its species, if incautiously handled, to inflict a bite at the end of the fingers, and produce the complaint called a whitlow. It inhabits soft stagnant waters, is from four to six inches long, and is almost perpetually twisting itself into various contortions and knots.

The two last kinds I shall enumerate under this order of worms are, the lumbricus or earth-worm, including the dew-worm and the slug; and the hirudo or leech, both of them too well known under several species to require any farther remark in the present rapid outline. This order includes nearly the whole of M. Cuvier's class of worms, with the exception of sea-worms, already adverted to.

The SECOND ORDER of the WORM CLASS is denominated MOLLUSCA, MOLLUSCOUS, OR SOFT-BODIED SHELL-WORMS; and consists, for the most part, of similar animals to those found in snail, oyster, nautilus, and other shells, but without a shelly defence: and hence, in their ordinal character, they are described as simple animals, naked, but furnished with limbs, of some kind or other. By this last mark they are distinguished from the preceding, or intestinal order, which, as already observed, consists of simple animals, naked and destitute of limbs. To place the order more immediately before you, I shall select a few examples from those animals that are most familiar to us, or are most remarkable for the singularity of their structure or other properties.

The limax or slug, is one of the most simple animals that belongs to this order: its only limbs are four feelers, tentacles, or horns, as they are commonly called, situate above the mouth, with a black dot at the tip of each of the larger ones, which is supposed to be an eye, though this point has not been fully established. Another genus of molluscous worms is the terebella; one species of which is the ship-worm, with an oblong, creeping, naked body, and numerous capillary feelers about the mouth, from four to six inches in length. It is sometimes enclosed in a testaceous or shelly tube, and is then called termes, pipe-worm, or shelly ship-worm, and belongs to the next order. In both forms it is peculiarly destructive to shipping; boring its way into the stoutest oak planks with great rapidity and facility; and chiefly forming a necessity for their being copper bottomed. The animal is, in its habits, gregarious; and hence, in attacking a vessel, it advances in a multitudinous body, every individual punctiliously adhering to its own cell, which is separated from the adjoining by a partition not thicker than a piece of writing-paper. In a preceding lecture, however, I had occasion to observe, when glancing at the shelly ship-worm, or teredo *navalis*, that by its attacking the stagnant trunks of trees and other vegetable materials, that in many parts of the world are washed or thrown down by torrents and tornadoes from the mountains, and block up the mouths of creeks and rivers, and thus powerfully contributing to the dissolution of dead vegetable matter, it produces far more benefit than evil; the benefit being universal, but the evil partial and limited. In 1731 and 1732 they appeared in great numbers on the banks of Zealand, and considerably alarmed the Dutch, lest the piles by which these banks are supported should have been suddenly destroyed. They never, however, staid long enough to commit mischief, the climate, perhaps, being too cold for them.

Another genus worthy of notice under this order is the actinia, which includes those species of naked sea-worms which are vulgarly called sea-daisy, actinia *Bellis;* sea-carnation, a. *Dianthus;* sea-anemony, a. *Anemonoides;* and sea-marigold, a. *Calendula;* from their resemblance to the stems and flowers of these plants. The first three are found on the warmer rocky coasts of our own country, as those of Sussex; and the last on the shores of Barbadoes. The sea-carnation is sometimes thrown upon our flat coasts, and left evacuated of its water by the return of the tide; in which case it has the appearance of a slender, long-stalked, yellow fig.

Most of us are acquainted with some species of the sepia or cuttle-fish, which is another genus of the order before us. The common cuttle-fish, sepia *officinalis*, is an inhabitant of the ocean, and is preyed upon by the whale and plaise tribes; its arms are also frequently eaten off by the conger-eel, but are reproducible. The bony scale on the back is that alone which is usually sold in the shops, under the name of cuttle-fish, and is employed in making pounce. These animals have the singular power, when pursued by an enemy, of squirting out a black fluid or natural ink, which darkens the waters all around, and thus enables it to escape. This natural ink forms an ingredient in the composition of our Indian inks. The worm or fish, was formerly eaten by the ancients, and is still occasionally used as food by the Italians. In hot climates, some of the species grow to a prodigious size, and are armed with a dreadful apparatus of holders, furnished with suckers, by which, like the elephant with its proboscis, they can rigidly fasten upon and convey their prey to the mouth. In the eight-armed cuttle-fish, sepia *octopodia*, which inhabits the Indian seas, the arms or holders, are said to be not less than nine fathoms in length. In consequence of which the Indians never venture to sea without hatchets in their boats to cut off these monstrous arms, should the animal attempt to fasten upon them, and drag them under water. This genus, with that of the argonauta and nautilus, constitute the order CEPHALOPODA of Cuvier, which belongs to his class named MOLLUSCÆ.

The medusa is another genus entitled to attention, as affording various species that shine with great splendour in the water. The worms of this kind are vulgarly denominated sea-nettles, and consist of a tender gelatinous mass, of various figures, furnished with arms or tentacular processes, issuing from the under surface. The larger species, when touched, produce in the hand a slight tingling and redness, and hence, indeed, the name of sea-nettles, by which they are commonly distinguished. A few of the species are found on our own coasts; but by far the greater number are exotics.

The asterias, sea-star, or star-fish, is another genus of molluscous worms, and, in some of its species, is known to all of us. The most curious species of this genus is the asterias *Caput Medusæ* or basket-fish; which inhabits most seas, and consists of five central rays, each of which divides into two smaller ones, and each of which smaller ones again divides into two others; the same kind of division, and subdivision, being continued to a vast extent, and every ray regularly decreasing in size, till at length the ramifications amount to many thousands, forming a beautiful net-work spread over the water. The colour of the worm varies: being sometimes pale, sometimes reddish-white, sometimes brown.

The only other genus I shall mention under this order, is the echinus, sea-urchin, or hedge-hog: its species are very numerous, and of a great multiplicity of forms, globular, oval, shield-like, and heart-shaped. Many of them appear to have long since become extinct, and are only to be found in a state of petrifaction. The surrounding spines form an admirable coat of mail when perfect; but they are generally broken off from the shell when it is picked up empty on our own coasts.

The THIRD ORDER of the Linnéan class of WORMS are called TESTACEA or TESTACEOUS; and comprise those that are surrounded with a shelly or testaceous covering. They are of three kinds; those possessing a single shell, of whatever form or kind, and hence denominated univalves; those possessing two shells, which are called bivalves or conchs; and those possessing more than two shells, which are in consequence named multivalves.

The UNIVALVES, or SINGLE-VALVED, are the most numerous, and exhibit the greatest variety of forms. For the most part they are regularly or irregularly spiral: among the most common of them may be mentioned the helix or snail-genus; the patella or limpet; and the turbo or wreath-genus, of which the periwinkle is a species; the animal in all which is a limax or slug. Among the more curious, are the murex or purple-shell so highly valued by the ancients for the exquisite dye it is capable of producing; the volute or mitre, including those fine polished spiral shells, without lips or perforation, which so often ornament our chimney-pieces, sometimes embellished with dots, and at other times with bands of colours of various hues; the strombus, comprising the larger shells appropriated to the same purpose, spiral like the volute, but with a large expanding lip spreading into a groove on the left side, and often still farther projecting into lobes or claws, the back frequently covered with large warts or tubercles, in some species called coromant's foot; in all which, the animal or inhabitant is still a limax or slug; and the nautilus and argonauta, the pearl-nautilus and paper-nautilus; the first of which is lined with a layer of a most beautiful pearly gloss, and in the East is manufactured into drinking-cups; and the second of which is remarkable for its exquisite lightness, and the rumour common to most countries of its having given to mankind the first idea of sailing. In reality, it sails itself, and with exquisite dexterity; and to this end the animal that is usually found inhabiting the shell, and which, till of late, was supposed to be a four-armed cuttle-fish, though now regarded as an ocythoe, by Dr. Leach named o. Cranchii, in memory of the indefatigable, but unfortunate branch of the British Museum,* as soon as it has risen to the surface, erects two of its arms to a considerable height and throws out a thin membrane between them, thus producing a natural sail; while the oars or rudder are formed by the other two arms being thrown over the shell into the water, by which ingenious contrivance, or rather instinctive device, the paper-nautilus sails along with considerable rapidity. M. Cuvier has separated the nautilus from the rest, though distinctly an univalve; and, as we have already noticed, has united it with the cuttle-fish, under an order of MOLLUSCÆ, which he calls CEPHALOPODA. The ordinal name for the others is with him GASTEROPODA, as most of them crawl on their bellies, and carry the shell over them as a shield. They have a distinct and moveable head, by which they essentially differ from our next order, which are without a distinct head of any kind. The two sexes are united in the same individual, but require a reciprocal union for breeding.

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* See Series I. Lect. XI. p. 119.

The BIVALVED OF TWO-SHELLED TESTACEOUS WORMS, the acephala or headless of Cuvier, are best explained by referring you to the oyster and the muscle, (ostrea and mytilus,) both which contain species that produce pearls, and mother of pearl. Though the real pearl-muscle is amya or gaper, found chiefly on the coasts of Malabar and Ceylon, where the principal pearl-fisheries are established. The species of oyster that produces small pearls is sometimes traced on our own shores, and is said to have been at one time frequent in the river Conway, in Wales. Most of the oysters cast their spawn towards the close of the spring, or in the beginning of the summer, as the month of May. This spawn is by the fishermen called SPAT, and in size and figure each resembles the drop of a candle. As soon as cast or thrown off, these embryon disks adhere to stones, old oyster-shells, pieces of wood, or whatever other substance comes in their way ; a calcareous secretion issues from the surface of their bodies, and in the course of twenty-four hours begins to be converted into a shelly substance. It is two or three years, however, before they acquire their full size.

The scallops, which are a tribe belonging to the oyster kind, are capable of leaping out of the water at pleasure, to the distance of half a yard : when elevated they open their shells, and eject the water within them, and then falling back into the water close them with a loud snap.

Among the more elegant of this division, is the nacre, pinna, or sea-pen, so called from its form ; the animal of which, (a lamix or slug) secretes, as we have already observed, a large quantity of fine strong silky hair, or beard, which by the Italians is woven into a kind of silky plait. And among the most extraordinary is the gigantic chama or clamp-shell, in form resembling the oyster : one species of which we noticed not long since, as found in the Indian ocean, of the weight of between five and six hundred pounds ; the fish or inhabitant large enough to furnish a hundred and twenty men with a full meal, and strong enough to lop off a man's hand, and cut asunder the cable of a large ship.

Of the MULTIVALVED TESTACEOUS WORMS, or those containing more than two shells, there are but three known species, the chiton, the lepas or acorn-shell, and the phloas, or as it is often improperly called pholas, so denominated from its secreting a phosphorescent liquor of great brilliancy, which illuminates whatever it touches or happens to fall upon, and to which Linnéus chiefly ascribed the luminous appearance which the sea often assumes at a distance : a subject, however, which we shall have occasion to examine hereafter.

The FOURTH ORDER of the Linnéan class of WORMS is called ZOOPHYTES, or PLANT-ANIMALS, so denominated from their efflorescing like plants. Most of them are of a soft texture, as the hydra or polype, so well known from its being capable of existing when turned inside out, and of reproducing any part of its tentacles or body when destroyed by accident. Some are corky or leathery, as different species of the alcyonium ; some bibulous, as the spongia or sponge, which is now decidedly ascertained to be an animal substance ; and some calcareous, as the numerous families of coral, which under the form of tubular, starry, or stony stems, are denominated tubipores, madrepores, and isises.

The FIFTH OF INFUSARY ORDER OF WORMS, comprehends those minute and simple animalcules which are seldom capable of being traced, except by a microscope; and, for the most part, reside in putrid infusions of vegetables, or in stagnant waters filled with vegetable matter. Of these, the smallest known species is denominated monas. To a glass of the highest magnifying power it appears nothing more than a minute simple point or speck of jelly, obviously, however, evincing motion, but often from its delicacy seeming to blend itself with the water in which it swims.

Such is a bird's-eye view of the Linnéan class of worms, and its five orders of intestinal, molluscous, testaceous, zoophytic, and infusory animals.

The INSECTS form the NEXT CLASS in an ascending scale; classically characterized as small animals, breathing through lateral spiracles, armed on all sides with a bony skin, or covered with hair; furnished with numerous feet and moveable antennæ or horns, which project from the body, and are the probable instruments of sensation. They are so voluminous in their orders, as well as in the genera belonging to the class, (this single class containing, perhaps, as many species as are known to the whole twenty-four classes of the vegetable kingdom,) that our time will allow us to do little more than instance the names of a few of the most common and familiar kinds, under the ordinal arrangement. The orders are seven; all insects being included under the technical names of coleopterous, hemipterous, lepidopterous, neuropterous, hymenopterous, dipterous, and apterous; or to exchange the Greek for English terms, under those of crustaceous-winged; half-crustaceous-winged; scaly-winged; reticulate or net work-winged; membranaceous-winged; two-winged; and wingless. From all which it is obvious that the ordinal character of insects is derived from the general idea of wings; to which I may add, that under this general idea, while the individuals of the last order are destitute of wings, and those of the last but one are only possessed of two wings, the individuals of the preceding five orders have four wings each, though not particularly specified in their ordinal names.

The COLEOPTEROUS OR CRUSTACEOUS-WINGED INSECTS, constituting the FIRST ORDER, are by far the most numerous; and as the ordinal term imports, embrace all those whose wings are of a shelly or crustaceous hardness; and are sub-distinguished by the nature of their antennas as being clubbed at the end, thread-like, or bristly. Among the more familiar of this order, I may mention the scarabæus or beetle-kinds, a very numerous race, equally distinguished by the metallic lustre of their wing-shells, and their attachment to dunghills, and other animal filth. The dermestes or leather-eater, the larves or grubs of one species of which are found so perpetually to prey on the bindings and books, and sometimes even on the shelves, of libraries. The coccinella or lady-bird; the curculio or weavil, the larve of which is found so frequently in our filbert and hazel nuts, and which secretes such a quantity of bile as to give the nut a bitter taste to a considerable extent beyond the place in which it is immediately seated.

The ptinus, producing in one of its species the death-watch, is another insect belonging to this order, whose solemn and measured strokes repeated in the dead of the night, are so alarming to the fearful and superstitious; but which, as we formerly noticed, merely proceed from the animal's striking its little horny frontlet against the bed-post it inhabits, as a call of love to the other sex. The lampyris or glow-worm; the cantharis or Spanish-fly; and the forficula or ear-wig: the last of which is characterized by the singularity of its brooding over its young like a hen, and only leaving them at night, when it roams abroad in quest of food for their support. A few of these, as the lady-bird and ear-wig, are by M. Cuvier taken away from the present order, and, with several of the ensuing, as the cockroach, locust, and grasshopper, carried to a new order, which he has named ORNITHOPTERA.

The SECOND ORDER OF INSECTS, entitled HEMIPTERA or half-crustaceous, and by some writers RHYNGOTA, has the two upper of the four wings somewhat hard or shelly, though less so than the preceding, while the two lower wings are for the most part soft and membranaceous. To this order belongs the coccus or cochineal insect, the blatta or cockroach, of which the chaffer is a species; the gryllus or locust, of which one species is the little cheerful chirping cricket; the cicada or grasshopper, still more celebrated for its musical powers than the cricket; and the cimex or bug, celebrated also, but for powers which you will, perhaps, spare me from detailing.

The THIRD ORDER OF INSECTS, COLEOPTERA, or SCALY-WINGED, contains but three genera or kinds; and these are the papilio or butterfly, the phalæna or common moth, and the sphinx or hawk-moth; which last has a near resemblance to both the others, and flies with a humming noise, chiefly in the morning and evening, as the moth flies chiefly in the evening and at night, and the butterfly only in the day-time. They have all a general resemblance to each other, and feed equally on the nectary of flowers: the antennas of the butterflies are mostly knobbed or clubbed at the tip; those of the moths are moniliform, those of the sphinxes tapering.

The NEUROPTEROUS INSECTS, or those with four reticulate or net-work wings, form the FOURTH ORDER of the Linnéan class; and they may be exemplified by the ephemera and hemerobius, the day-fly and May-fly of the angler, those little busy insects that surround us in countless multitudes when we walk on the banks of a river in a fine summer's evening, and the whole duration of whose life, in a perfect state, seldom exceeds two days: and often not more than as many hours; while it has comparatively a long life in its imperfect state, or previous to its metamorphosis. It is the agnathat of several entomologists. This order is not numerous, and I will therefore only add another example, the libellula or large dragon-fly, so denominated from its ferocity towards smaller insects; usually seen over stagnant waters, the more common species, libellula *Virgo*, possessing a beautiful, glittering, and green-blue body, with wings bluish towards the middle. The larve in its internal parts, is larger than the insect, and catches its prey at a distance, by suddenly darting forward the lower lip. The tracheæ, or respiratory organs, are singularly placed at the verge of the tail. It is the ordonata of Cuvier.

The FIFTH ORDER OF INSECTS comprises the HYMENOPTERA, the piezata of some entomologists, or those possessed of four membranaceous wings; most of which are armed with a sting at the tail. They of course include the apis and vespa, or wasp and bee. To which I may add the formica or ant, the ichneumon, and the cynips or gall-fly, to which we are indebted for our gall-nuts, whose peculiarities and habits I shall hereafter have an opportunity of reverting to.

The SIXTH ORDER OF INSECTS is denominated DIPTERA, and deviates from all the preceding in possessing only two wings instead of four. It includes among others the musca or common fly, the hippobosca or horse-fly, the oestris or gad-fly, the tipula or father-long-legs, and the culex or gnat. It is sub-distinguished into such animals as possess a sucker with a proboscis, and such as possess a sucker without a proboscis. This order is the antliata of some entomologists.

The LAST ORDER OF INSECTS differs still more largely from all that have been hitherto noticed; for it consists of those kinds that have no wings whatever, and hence the class is called APTERA or wingless. To this order belong most of those insects that are fond of burrowing in animal filth, upon the animal surface; as the pulex, pediculus, and acarus, the flea, louse, and itch-insect. To the same order belongs also the aranea or spider; the oniscus, wood-louse or millepede; the scorpio or scorpion, and even the cancer or crab, and lobster: the Linnéan system making no distinction between land and water animals from the difficulty of drawing a line; of which indeed the cancer genus is a very striking example, since one of the species, cancer *ruricola*, or land-crab, is, as we have already seen, an inhabitant of woods and mountains, and merely migrates to the nearest coast once a-year for the purpose of depositing its spawn in the waters. These, however, are separated from the class of insects in M. Cuvier's classification, and form a distinct class by themselves under the name of CRUSTACEA; while the greater part of the rest, as spiders, water-spiders, spring-tails, millepedes, centipedes, and scorpions, are also carried to a distinct order of the insect class, which he has called GNATHAPTERA, leaving to his own order of APTERA nothing more than the first three of the preceding list, the flea, louse, and tick or itch-insect.

But of all the animals belonging to this division under the Linnéan classification, I should mention, perhaps, an account of its singular instinctive faculties, the termes or white ant. The kind which inhabits India, Africa, and South America is gregarious, and forms a community, far exceeding in wisdom and policy the bee, the ant, or the beaver. The houses they build have the appearance of pyramids, of ten or twelve feet in height; and are divided into appropriate apartments, magazines for provisions, arched chambers and galleries of communication. The walls of all these are so firmly cemented that they will bear the weight of four men without giving way: and on the plains of Senegal, the collective pyramids appear like villages of the natives. Their powers of destruction are equal to those of architecture; for so rapidly and dexterously will they destroy, in less bodies, food, furniture, books, clothes, and timber of whatever magnitude, leaving in every instance the merest thin surface, that a large beam will in a few hours be eaten to a shell not thicker than a page of writing paper.

It was my intention to have finished our survey of the Linnéan system in the course of the present lecture; but the prospect swells so widely before us that it is impossible; and the remaining four classes of fishes, amphibials, birds, and mammals, must be reserved for another study.

In the mean time, allow me to remark, that low and little as the tribes we have thus far contemplated may appear, they all variously contribute to the common good of animal being, and aid, in different ways, the harmonious circle of decomposition, renovation, and maturity of life, health, and enjoyment. The insect tribes, beautiful as they are in their respective liveries, may be regarded as the grand scavengers of nature. Wherever putridity is to be found, they are present to devour the substance from which it issues; and such is the extent and rapidity of their action, that it has been calculated by some naturalists that the progeny of not more than a dozen flies will consume a dead carcass in a shorter space than a hungry lion. Thus, while they people the atmosphere they purify it; and in many instances, perhaps, and by tribes invisible to the naked eye, purge it of those noxious particles with which it is often impregnated, and which, at certain seasons, are apt to render it pestilential.

The indefatigable labour of the worm-tribes in promoting the general good is still more striking and manifest. The gordius or hair-worm perforates clay to give a passage to springs and running water; the lumbricus or earth-worm pierces the soil that it may enjoy the benefit of air, light, and moisture; the terebella and teredo, the naked ship-worm and the shelly ship-worm, penetrate dead wood, and the phloas and mytilus, rocks to effect their dissolution; while the termes or white ant, as we have just observed, attacks almost every thing within its reach, animal, vegetable, or mineral, with equal rapacity, and reduces to its elementary principles whatever has resisted the assault of every other species. The same system of warfare is, indeed, pursued among themselves; yet it is pursued, not from hate, as among mankind, but from instinct, and as the means of prolonging and extending as well as of diminishing and cutting short the term of life and enjoyment.

It has often been urged against the goodness, and sometimes against the existence of the Deity, that the different tribes of animals, are, in this manner, allowed to prey upon one another as their natural food, and that a large part of the globe is covered with putrid swamps, or wide inhospitable forests, or merely inhabited by ravenous beasts and deadly serpents.

Presumptuous murmurers! and what would *your* wisdom advise were Providence to consult you upon so glaring an error? Would you then leave every rank of animals to perish by the mere effects of old age? With the example so often before you of the misery endured by a favourite horse or a favourite dog when suffered to drain out the last dregs of existence in the midst of ease he cannot enjoy, and of food he cannot partake of—a misery which often compels us, as an act of mercy, to anticipate his fate, even at last, by the aid of violence,—would you abandon every animal to the same wretchedness, only, a hundred fold multiplied by the horrors of want and hunger which he must, by growing every day more infirm, be every day growing more incapable of appeasing?—Or would you cut short the evil at once, by destroying death itself and thus rendering every animal immortal? They would not thank you for such an interference, nor applaud the vain benevolence that might dictate it; an interference which, by preventing the necessity for offspring, would extirpate from the animal frame its best feelings; which would extinguish the wise and harmonious distribution into sexes; and make an equal inroad on the pleasures of sense and the endearments of instinct.

It is granted, that a great part of the globe is an inhospitable wilderness; that it consists, to a considerable extent, of waste inaccessible jungle overrun by rapacious beasts and reptiles, of putrid swamps crowded by myriads of venomous insects, and of immense warrans burrowed by countless hordes of the hampster, the mole-rat, and the white ant. Even here, however, wherever life exists, it exists to those that possess it as an enjoyment; while these very scenes and these very animals only fill up what man has no occasion for, and equally and instantly disappear as soon as he presents himself, and exercises that industry and ingenuity which alone constitute his authority, and upon which alone his health and his happiness are made to depend.

But this is not all.—While in their different gradations these outcasts from man are thus enjoying life themselves, they are preparing, in the best manner possible, the various tracts they occupy, for his future use and habitation. The soil that supports us, and gives us our daily bread, is nothing but a mixture of animal and vegetable materials; other substances indeed enter into it, but the great, the important, the active, and leavening constituent is of an organized origin. These materials, then, are perpetually forming, and accumulating, and rising into an unbounded and inexhaustible store-house of subsequent riches and plenty by the alternate generation and decomposition of the different kinds and orders of plants and animals which thus fill up, and, as we are apt to believe, encumber the regions we are contemplating; regions which, though in our own day unexplored or abandoned both by savage and civilized man, may, in that revolution of countries and of governments which is perpetually passing before our eyes, become, in some future period, the seat of universal dominion, the emporium of taste and elegance, of virtue and the sciences. So the fairest fields of Rome were formed out of the putrid Pontine marshes, and England has become what she is, from being a land of bogs and of blights, of wolves, wild-boars, and gloomy forests.

LECTURE II.

ON ZOOLOGICAL SYSTEMS, AND THE DISTINCTIVE CHARACTERS OF ANIMALS.

(The subject continued.)

In our last lecture we took a momentary glance at the history of zoology as a science, noticed the primary features of the best methodical arrangements to which it has given rise, and made some progress towards a brief delineation of that of Linnéus, which still takes the lead amidst the writers of the present day, and is hence chiefly entitled to attention in a course of popular study, generally collating it, however, with that of M. Cuvier, as we proceeded.

We observed that the Linnéan system comprehends all animals of every description whatever, under the six classes of mammals, birds, amphibials, fishes, insects, and worms. We pursued this arrangement in an ascending scale, as most consistent with the plan adopted at the opening of the present course of instruction; and commencing with the class of worms, finished with that of insects. It remains for us to prosecute the same rapid outline of inquiry through the four unexamined classes of fishes, amphibials, birds, and mammals.

Fishes are classically characterized in the Linnéan system as being always inhabitants of the water; swift in their motion and voracious in their appetite; breathing by means of gills, which are generally united by a bony arch; swimming by means of radiate fins, and for the most part covered over with cartilaginous scales.

The class is divided into six orders; the ordinal characters being taken from the position of the ventral or belly fins, or from the substance of the gills. The orders are, apodal, fishes containing no ventral or belly fins; jugular, having the ventral fins before the pectoral; thoracic, having the ventral fins under the pectoral; abdominal, having the ventral fins behind the pectoral. In all these four, the rays or divisions of the gills are bony. In the fifth order, which is called branchiostegous, the gills are destitute of bony rays; and in the sixth, or chondropterygious order, the gills are cartilaginous; all which will be easiest explained by a few familiar examples. Into the general divisions of this class M. Cuvier has introduced no change of any importance whatever, his own sections and names running parallel with those of Linnéus.

The kind best calculated to elucidate the FIRST OR APODAL ORDER, is the well known muræna or eel; since every one must have noticed, that this fish has no ventral, or, indeed, under fins of any kind. In many of its species, it has a very near approach to the serpent tribes; insomuch that several of them are called sea-serpents, and by some naturalists are described as branches of the serpent genus. Even our own common eel, muræna Anguilla, is often observed to quit its proper element during the night, and, like the snake, to wander over the meadows in search of snails and worms.

The next genus I shall mention, is the gymnotus, of which one species, gymnotus *electricus*, is the electric eel, an inhabitant of the rivers of South America, from three to four feet long, and peculiarly distinguished by its power of inflicting an electrical shock, so severe as to benumb the limbs of those that are exposed to it. The shock is equally inflicted whether the fish be touched by the naked hand, or by a long stick. It is by this extraordinary power, which it employs alike defensively and offensively, that the electric eel escapes from the jaws of larger fishes, and is enabled to seize various smaller fishes as food for its own use. There are, however, a few other fishes, as we shall have occasion to notice in proceeding, that possess a similar power, as the torpedo of European seas, and especially of the Mediterranean, and the electric silurus of those of Africa.

The only other genus it will be necessary to glance at under this order, is the xiphias or sword-fish; so denominated from its long sword-like and serrated snout, with which it penetrates and destroys its prey. Its chief species is found in the European and other Mediterranean seas, sometimes not less than twenty feet long; is very active, and, in one instance, has been known to attack an East Indiaman with so prodigious a force, as to drive its sword or snout completely through the bottom of the ship, and must have destroyed it by the leak which would hereby have been occasioned, had not the animal been killed by the violence of its own exertions; in consequence of which, the snout remained imbedded in the ribs of the ship, and no leak of any extent was produced. A fragment of this vessel, with the sword imbedded in it, has been long lodged as a curiosity in the British Museum.

The JUGULAR ORDER of fishes, distinguished by the ventral or belly-fins being placed before the pectoral or chest fins, is the next in succession, and contains only six separate kinds; of which, the two most familiar to our own country, are the gadus or cod-fish, including, among a variety of other species, the haddock, whiting, and ling; and the blennius or blenny, including several species of the hake. In these the ventral or belly fins are advanced so far forward, as to be immediately under the jole.

Of the THIRD OR THORACIC ORDER, in which the ventral fins lie somewhat backwarder, and directly under the pectoral or chest fins, I may instance, among those most familiar to us, the zeus or John dorée; the pleuronectes, including the numerous families of plaice, flat-fish, flounder, sole, turbot; the eyes of all which are situate on the same side of the head, in some species, on the left side, in others, on the right, but always on one side alone: the perca or perch, one species of which, perca *scandens*, has a power, like the eel, of quitting the water, and climbing up trees, which it effects by means of the spines on its gill-covers, and the spinous rays of its other fins: and the gasterosteus, or stickle-back. Among the more remarkable or curious kinds, I may mention the echeneis, remora, or sucking-fish, which inhabits the Mediterranean and Pacific seas; and though only from twelve to eighteen inches long, adheres so firmly to the sides of vessels and of larger fishes, by its head, that it is often removed with great difficulty; and was, by the ancients, supposed to have the power of arresting the motion of the ship to which it adhered. I may also mention the chætodon *rostratus*, beaked or rostrate chætodon; an inhabitant of the Indian seas, which curiously catches for its food insects that are flying over the surface of the sea, by ejecting water from its tubular snout with so exact an aim as to strike and stun them with the greatest certainty, and hereby to bring them down into its jaws.

The FOURTH ORDER of the Linnéan class of FISHES, is called ABDOMINAL; in consequence of having the ventral or belly fins placed considerably more backward, and behind the pectoral or chest fins: and here, as in all the preceding, the gills are bony. The salmo, or salmon, with its numerous families of trout, smelt, char and grayling; the esox or pike, including the gar-fish; the clupea or herring, which as a genus comprises the pilchard, sprat, and anchovy; the cyprinus or carp, including the gold-fish, gudgeon, tench, and a variety of similar species; the mugil or mullet, are among the more familiar kinds of this extensive order.

Of these, the herring is one of the most remarkable, from its migratory habits; and the carp, from its great longevity, having in many instances been known to reach more than a hundred years of age, and from its facility of being tamed, and made to approach the edge of a fish-pond on the sound of its dinner-bell, and to eat crumbs of bread out of a man's hand.

But amidst the most singular of the kinds belonging to this order is the exocœtus or flying fish, which, though occasionally traced in other seas, is chiefly found between the tropics, and has a power, by means of its long pectoral fins, of raising itself out of the water and continuing suspended in the air till these fins become dry; by which means it effectually avoids the jaws of such predatory fishes as are in pursuit of it. But unhappily it is often seized at the same time by the talons of ospreys, sea-gulls, or some other rapacious birds, that are perpetually hovering over the water to take advantage of its ascent. There are, however, various other fishes that have a similar power of flight or suspension, and from a similar cause, but none in so complete a degree. It is to this curious power Dean Swift makes allusion in the following lines:

> "So fishes, rising from the main,
>   Can soar with moisten'd wings, on high;
> The moisture dried, they sink again,
>   And dip their wings again to fly."

The FIFTH ORDER OF FISHES is denominated BRANCHIOSTEGOUS, in consequence of its gills being destitute of bony rays; by which it is peculiarly distinguished from all the preceding orders, and obtains a mark which has been laid hold of by Linnéus as constituting its ordinal character. It consists for the most part of a group of sea-monsters, or natural deformities, if the term might be allowed; as the ostraceon or trunk-fish, the diodon and tretradon, sun-fish, and lump-fish, many of which are so completely truncated at either end as to resemble the middle part of any common large fish with its head and tail lopped off; the syngnathus, pipe or needle-fish; and the lophius or frog-fish. In one of the species of this last kind we meet with a singular decoy for entrapping smaller fishes as its prey This species, l. piscatorius, which is about seven feet long, and inhabits most European seas, lurks behind sand-hills or heaps of stone, and throwing over them the slender appendages on his head, which have the appearance of worms, entices the smaller fishes to advance and play around them till they come within his reach, when he instantly darts forward and secures them as his spoil.

The SIXTH and last ORDER OF FISHES is denominated CHONDROPTERYGIOUS, as having the gills wholly cartilaginous, which constitutes its ordinal character. It includes, among other kinds, the acipenser or sturgeon, squalus or shark, raia or ray, petromyzon or lamprey, and gastrobranchus or hag-fish. Of these one of the most useful is the sturgeon: its different species may be ranked among the large fishes; they are inhabitants of the sea, but ascend rivers annually. The flesh of all of them is most delicious; from the roe is procured the sauce called caviare, and from the sounds and muscular parts is made isinglass. They feed on worms and other fishes, and the females are larger than the males.

This order, in the shark, contains the most dreadful of all the monsters of the main. The squalus *Carcharias*, or white shark, which often extends to thirty feet in length, and four thousand pounds in weight, follows ships with a view of devouring every thing that comes in his way, and has occasionally been known to swallow a man whole at a mouthful. But in order to guard us in some degree against the perils of their presence, a peculiar stream of light issues in the dark from their tapering subcompressed bodies, which cannot well be mistaken; and as some compensation for their rapacity, we obtain from their liver a large quantity of useful oil, and find in their skin a very valuable material for carriage-traces in some countries, and for polishing wood, ivory, and other hard substances, in all countries.

The next class to that of fishes in an ascending direction is named AMPHIBIA; which, for the sake of brevity, and having no English synonym to meet it, I shall take leave now, as I have on former occasions, to render AMPHIBIALS. The term, indeed, whether regarded as Greek or English, is not very strictly precise in its present application; for it intimates an intention to include in this class all animals capable of existing in the two elements of air and water. We have already observed, however, that there are various fishes, as the eel-tribe generally, one species of the perch, and two or three of the exocœtus or flying-fish, to which many more might be added that are capable of existing in air as well as in water; while the insect kinds offer us a still greater number that are similarly endowed, and the worms a still more numerous train. It has been said, indeed, that the animals of this class have a peculiar agreement in the structure of their organs of respiration, which makes an approach to that of birds and quadrupeds, and differs very essentially from that of fishes, insects and worms. Upon the whole, however, there is no class that offers so great a diversity in the make of its respiratory organs as the class before us, of which I had occasion to take notice in the progress of our last series of study In the tortoise and others among the more perfect of the amphibious tribes, the remark of their approximation to the respiratory organs of the higher classes will unquestionably hold; but it will by no means hold in various cases of the lizards; while the proper place for the siren, which is possessed of both lungs and gills, remains doubtful to this moment: it is sometimes grouped among the fishes, sometimes in the order of amphibious reptiles; while Linnéus, after having in the earlier editions of his system fixed it in this last situation, appears to have intended, had his life been spared long enough, to have formed a new order of amphibials for the express purpose of receiving it, which he proposed to denominate MEANTES.*

As the Linnéan class of amphibials at present stands, it consists of not more than two orders, REPTILES, or amphibious animals possessing feet: and SERPENTS, or amphibious animals without feet. The different kinds under each are but few: the reptiles containing only five; the testudo, draco, lacerta, rana, and siren; or, in plain English, the tortoise, flying dragon, lizard, frog or toad, and siren. The serpents comprise only seven genera; the crotalus, or rattle-snake; boa; coluber or viper; anguis, harmless snake or blind-worm; amphisbæna; cœcilia; and achrochordus.

Among the REPTILES, the most extensive and important kind is the lacerta or lizard; for it includes, among other species, the alligator, crocodile, proper lizard, chameleon, salamander, newt, and eft.

Among the seven genera of SERPENTS, the first three, rattle-snake, boa, and viper, or rather coluber, are more or less poisonous; the rattle-snake in all its species, which are six or seven; the boa, in five, out of about seventeen; and the coluber or viper, in about thirty, out of about a hundred and thirty: the two most fatal of which last are, C. *Cerastes*, or horned serpent: and C. *Naja*, hooded serpent, or cobra de capello. In both Asia and Africa we meet with whole tribes of barbarians, who are capable of handling the most poisonous of these amphibials, and of eating them up alive from head to tail, without the smallest injury: even the bite itself producing no mischief. These barbarians, some of whom were known to the Greeks and Romans, and are particularly alluded to by Celsus and Lucan, were formerly called Psylli. The power they affect has been laughed at by M. Denon, but without any kind of reason for derision. It is a curious subject, however, and connected with others of equal singularity; and must, therefore, be reserved for a future study.†

The poisonous serpents differ from each other in their respective kinds, by having their bodies more or less covered with scuta or plates, instead of with mere scales; excepting that the rattle-snake is chiefly distinguished by the rattle at his tail. The four harmless genera are characterized by having their bodies covered altogether with simple scales, and never with plates, or as being ringed, wrinkled, or tubercled.

This class is not much disturbed by M. Cuvier's later arrangement; but he has separated the tortoises from the lizards, denominating the first, as an order, CHELONIA; and the second, SAURIA; and has removed the frogs, salamanders, and siren, into a fourth order, to which he has given the name of BATRACHIA, characterizing them by the possession of a naked skin; feet; with branchiæ in the young.

But we must hasten in our rapid career to the BIRD CLASS, distinguished by having the body covered with feathers and down; protracted and naked jaws; two wings, formed for flight; and biped. This class consists of six orders: accipitres; picæ; anseres; grallæ; gallinæ; passeres. In English synonyms, birds of prey; pies; web-footed birds; waders; gallinaceous birds; and the mixed classes of thrushes, sparrows, and finches. These orders are chiefly distinguished from each other by the peculiar make of the bill, and of the feet. Under M. Cuvier's classification the divisions, and even the names are the same, with the exception that for picæ, or pies, he has given the better appellation of scansores or climbers. Every one of them, or rather every distinct kind under every one of them, might agreeably occupy us through an entire lecture; so curious, so attractive, so interesting, are their structures, their powers, their habits, their instincts. But all these must be reserved for subsequent studies.* Our only concern at present is to give a glance at the manner in which they are grouped under the Linnéan system. It is the mere alphabet of the science to which we must at present confine ourselves.

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* Gmelin and Camper introduced it into the class of fishes; and in Turton it occurs in the class Mammalia, order Bruta, as a variety of the trichechus manati, or lamantin.

† See Lect. VI. of this Series.

The ACCIPITRES, or predacious birds, constituting the FIRST ORDER, with a bill somewhat hooked downward, and four claws hooked and sharp-pointed. It consists of not more than four genera, the vulture, including the conder, (v. *Gryphus*,) as one of its species; the falco, including the numerous families of the eagle, falcon, hawk, osprey, buzzard, and kite, together with various others: the owl, and the lanius, or shrike, of which the butcher-bird, (l. *Collurio*,) is one of the chief species.

The PICÆ OR PIES, form the SECOND, and most numerous order. The bill is here compressed and convex, which constitutes the ordinal character. A secondary distinction, taken from the feet, divides them into tribes formed for perching, formed for climbing, or formed for walking. To this order belongs the trochilus, or humming-bird, the minutest animal of the bird tribes; and which seems to connect the bird with the insect class. In one of its species, trochilus *minimus*, or least humming-bird, it sometimes does not weigh more than twenty grains, nor measure much more than an inch; it is consequently less than several of the bee tribes, and like the bee, feeds on the nectar of flowers, which it hovers about and extracts while on the wing, with a delighted hum.

To this order also, from similarity of bill and foot, belong the very numerous families of the psittacus or parrot kind, including the proper parrot, maccaw, parrakeet, cockatoo, and lory; equally celebrated for their imitative powers, their longevity, and the splendid variety of their colours; the paradisea, or bird of Paradise, chiefly a native of New Guinea, and distinguished by the long and taper elegance of its bending feathers; the monstrous rhamphastos or toucan, whose bill is, in some species, larger than its body, and whose tongue is quaintly tipped with a bundle of feathers, probably answering the purpose of an organ of taste.

All thus far glanced at are exotics. Among the kinds a few of whose species are inhabitants of our own country, I may mention the social and clamorous corvus or crow-tribe, including the rook, raven, jay, jack-daw, and various others; the picus or wood-pecker, that drives into the stoutest and toughest timber-trees of the forest its hard and wedge-like bill, and often with a force and echoing sound like the stroke of the woodman; and whose bony and pointed tongue transfixes the various insects upon which it feeds, and in this state not unfrequently draws them out from a considerable depth in the bark of trees into which they have crept for protection. The alcedo, or king-fisher, is another genus of this order, whose species haunt streams and rivers for the little fishes on which they feed, and are most dexterous anglers in catching them. To these we may add the cuculus or cuckoo, that, with the same want of natural affection which marks the ostrich, builds no nest for its eggs, except under particular circumstances, but avails itself of that of the hedge-sparrow, or some other bird, and abandons to foster-parents the care of its eggs.

The THIRD ORDER of birds is denominated ANSERES, and in English WEB-FOOTED: they are ordinarily characterized by having the bill covered with skin, broad or gibbous at the tip, and a palmate or web-foot, formed for swimming: the tongue is uniformly fleshy, and the bill, in many instances, denticulate or toothed. It includes only thirteen kinds, of which I may take as examples, the anas, comprehending the very numerous families of duck, goose, swan, wild duck, teal, and shoveller; the mergus or merganser; alca or hawk; aptenodytes or penguin; pelecanus or pelecan; colymbus, comprising the grebes, guillemots and divers, and procellaria or petrel. The petrels have an extraordinary habit of spouting from their bills a considerable quantity of oil upon any object that offends them. The procellaria *pelegica*, or stormy petrel, is the most daring of all birds during a tempest, though not more than six inches long. The moment he beholds the black clouds collecting, he quits his rocky retreat and enjoys the magnificent and growing spectacle; he darts exultingly athwart the concave, and skims with triumphant temerity the loftiest peaks and deepest valleys of the most tremendous waves. The appearance of this bird is, to the sailor, a sure presage of an approaching storm.

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* See Lect. IV, V. VIII. IX. of this series.

The GRALLÆ or WADERS, form the FOURTH ORDER of birds, in the Linnéan system. They are characterized by possessing a roundish or subcylindric bill, a fleshy tongue, and legs naked above the knees. The ardea, or genus that includes the herons, cranes, and bitterns, is the most numerous. The scolopax, which includes the curlew, snipe, and woodcock; the tringa, which includes the sandpiper, the ruff and reeve, and the lapwing or pewit; the fulica, which includes the gallinule, coot, and moorhen; and the charadius or plover are among those that are most familiar to us. To this order also belongs the tantalus or ibis, so celebrated for the divine honours paid to it for many ages throughout Egypt; and, at least, a most valuable bird from its clearing the land of those numerous reptiles and insects, which are left upon its surface after the exundations of the Nile. It is the abu-hannes of Bruce, which, however, M. Cuvier regards as not properly a tantalus; and has, consequently, made a distinct genus for receiving it, to which he has given the name of neumenius; and hence, under this classification, it is a Neumenius *Ibis*, instead of a Tantalus *Ibis*.

The FIFTH ORDER embraces the GALLINÆ OR GALLINACEOUS BIRDS: those which strictly come under the denomination of poultry. They are chiefly characterized by having a convex bill, with the upper mandible arched. They are the least numerous of all the orders next the ACCIPITRES, and extend to not more than ten kinds or genera; many of which, however, are very extensive in their species. The kinds most familiar to us are the phasianus or pheasant, including all the families, and their numerous varieties of common cock and hen; the tetrao or partridge, including all the families and their numerous varieties of grouse, red-game, black-game, ptarmigan, and quail; the pavo or peacock; and meleagris or turkey. To this order also belong the numidia, pintadó or guinea-hen, the otis or bustard, the didus or dodo, and the struthio, including those large and stately birds, the emeu, cassowary, and ostrich: the last of which, though incapable of flying, derives from its wings a fleetness of running, that is unrivalled by any animal whatever. This bird is capable of being tamed, and may be conveniently rode; and Adanson asserts, that, when mounted, it will surpass the speed of the most rapid courser. He tells us, that while he was at the factory at Podore, he was in possession of two tame ostriches, the oldest of which, though young, would carry two negroes upon its back, with a rapidity superior to what has ever been exhibited by the fleetest racer upon the Newmarket turf.

The LAST ORDER of the bird class is entitled PASSARES, for which, in the sense here intended, we have no exact English synonym: but it is designed to include various kinds and families, which, for the most part, may be denominated small birds, and singing birds. They are characterized by having the bill conic, and sharp-pointed; and the nostrils naked. To this order belong the alauda or lark kind; the columba, pigeon, and dove kind; the emberiza or bunting, including the yellowhammer; the fringilla or finch, with all its numerous species of goldfinch, greenfinch, thistlefinch, linnet, and sparrow; the hirundo, including the swift, swallow, and martin; the loxia or grosbeak, including the bullfinch and hawfinch, the only finches I am at present aware of, that do not belong to the fringilla genus: and the motacilla, a most interesting group, as including the nightingale, whose song surpasses that of all the singing birds of the grove; and the redbreast, whose song is, indeed, less sonorous and striking, but who is so justly celebrated and beloved for his social qualities; together with all the amusing species and varieties of wrens and wagtails. To the order of passeres appertain also the pipra or manakin, some of which are peculiarly musical; and the turdus, comprising those sweet melodious choristers, the thrush, the throstle, and the blackbird.

Such is a brief and scanty survey of the interesting and instructive class of birds: and thus in the elegant language of the poet of the Seasons,

> Innumerous songsters, in the fresh'ning shade
> Of new-sprung leaves, their modulations mix
> Mellifluous. The jay, the rook, the daw,
> And each harsh pipe, discordant heard alone,
> Aid the full concert: while the stock-dove breathes
> A melancholy murmur through the whole.*

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* Catalogue of singing birds, with the time of their beginning and ceasing to sing, from a mean of five years' observation, with the numerical value of their notes, twenty being that of absolute perfection. From an interesting article by Mr. John Blackwell, in Memoirs of the Literary and Philosophical Society of Manchester. Second Series, vol. iv.

Name.	Begins.	Ends.	Mellowness.	Sprightliness.	Plaintiveness.	Compass.	Execution.
Redbreast	Jan. 3	Dec. 14	9	8	12	14	14
Wren	do. 13	do. 3	1	16	0	2	5
Missel Thrush	Feb. 1	May 28	3	4	1	5	3
Throstle	do. 8	Aug. 12	3	10	2	0	4
Skylark	do. 9	July 8	4	19	4	18	18
Hedge Warbler	do. 9	do. 19	3	4	3	4	4
Chaffinch	do. 10	do. 7	2	14	1	4	5
Starling	do. 15	May 30	4	2	2	4	2
Blackbird	Mar. 20	July 13	8	1	4	5	3
Green Grosbeak	do. 24	Aug. 12	5	3	5	5	5
Titlark	April 4	July 9	3	2	2	2	2
Lesser Redpole	do. 5	Aug. 5	1	4	0	3	3
Woodlark	do. —	Oct. 5	18	2	17	8	6
Goldfinch	do. 11	June —	4	16	4	10	12
Redstart	do. 14	do. 29	1	4	0	2	2
Willow Wren	do. 14	Aug. 23	6	4	5	5	5
Linnet	do. 15	July 6	10	15	6	12	19
Lesser Field Lark	do. 17	do. 8	8	7	5	4	5
Swallow	do. 19	Sep. 25	4	6	2	3	3
Stonechat	do. 24	June —	1	3	0	3	2
Whinchat	do. 25	July 1	1	3	0	2	2
Blackcap	do. 25	do. 22	14	19	12	10	8
Whitethroat	do. 29	do. 16	1	4	0	3	3
Pattychaps	May 12	do. 11	14	6	14	10	9
Sedge Warbler	do. 17	do. 16	2	16	0	18	14

Nor should we suffer their other curious endowments to pass by us unnoticed. The muscles, and delicate plumage of their wings, give them not merely the power of flight, but under different modifications, a nearly equal command over earth, air, and water: for such a provision enables the rail, destitute as he is of a webbed foot, to rival, in swimming and diving, the guillemot; the ostrich, as we have just observed, to outstrip in running the speed of the race-horse; and even the diminutive swallow, and various other migratory birds, to double, when on the wing, the pace of the fleetest ostrich; and to dart, twice a year, across the Atlantic and Mediterranean, often at the rate of a mile in a minute for several minutes in succession; and perhaps generally, and with perfect ease, at the rate of a mile every two minutes, or upwards of seven hundred miles every twenty-four hours, till it reaches the precincts of its summer or winter residence.

We ascend to the FIRST and HIGHEST CLASS—to that rank of animals which is most complicate in form, and most competent in power. This class is chiefly distinguished by the possession of lungs, and an organ for suckling; and most of its kinds possess four supporters in the shape of hands or feet, or both. To this last character the class was formerly indebted for its classic name, which was QUADRUPEDS, OF FOUR-FOOTED. As some of the kinds under it, however, in its modern arrangement, are possessed of no supporters of any sort, either hands or feet; others have four hands and no feet; and others, again, have two of each, the absurdity of retaining such a name must be obvious to every one; and hence it has been correctly and elegantly exchanged by Linnéus, for that of MAMMALIA, from the mammary or suckling organ which belongs to every kind of the class, as it stands at present, and to no kind whatever out of it: and which, as we have no fair synonym for it in our own tongue, I shall beg leave now, as I have on various other occasions, to render MAMMALS.

The class is distributed into seven orders; the characters of which are taken from the number, situation, and structure of the teeth. The seven orders are as follows:—primates, bruta, feræ, glires, pecora, belluæ, cete. It is difficult to find English synonyms for these Latin terms, which, in several instances, are used in a kind of arbitrary sense, not strictly pointed out by the terms themselves. The following are the best that occur to me: chieftains; brute-beasts; savage-beasts; burrowing-beasts; cattle; warriors; and whales.

The FIRST ORDER, PRIMATES OF CHIEFTAINS, is distinguished by the possession of four cutting teeth in each jaw. This mark would also include the race of man; and Linnéus has actually included him in the order before us, as he is included in the class by Cuvier and most of the naturalists. From such arrangements, however, I shall take leave to differ. Man ought to stand by himself; he has characters peculiar to himself, and which place him at an infinite distance from all other animals. With this exclusion, the entire class is reduced to three kinds, the simia or monkey; the lemur or maucauco; and the vespertilio or bat: kinds which can only be collectively entitled to the appellation of primates or chiefs, from their very slight resemblance to man in the general distribution of the teeth: for though a few of the monkey tribes have an approximation in their exterior and erect form, in the greater number this character is very inappreciate, while it is nearly lost in the lemur, and altogether so in the bat.

Among the simia kind, the most singular species is certainly the ourang-outang, especially the grave, gentle, and very docile Pongo. I have only time to observe farther upon this kind, that those without tails are denominated apes; those with short tails, baboons; and those with long tails, proper monkeys. Among the lemurs, the most curious, perhaps, is the l. *volans*, or flying maucauco, the galiopithecus *volans*, or flying colugo of Pallas and Shaw: an action which he is able to accomplish from tree to tree by means of a strong leathery membrane that surrounds the body and reaches from the head to the fore-feet, hind-feet, and extremity of the tail; and which gives him an approach to the bat.

Of the vespertilio or bat kind, which is well known to fly only by night, and by means of an expansive membrane, instead of by wings, one of its most extraordinary faculties is that of a knowledge of the presence, and apparently of the approach of objects, by some other sense of medium than that of vision; for when deprived of its eyes, this knowledge, and a consequent power of avoiding objects, seems still to continue. The vespertilio *Vampyrus*, or ternate bat, an inhabitant of India and Africa, is said to be fond of blood, and occasionally to fasten on such persons as he finds asleep, and to suck their veins till he becomes bloated. He might hence, under proper management, be rendered an able and valuable substitute for the leach. In poetry he has often been introduced, under the name of vampire, as a most hideous and appalling monster.

The SECOND ORDER, BRUTA, OR BRUTE-BEASTS, is distinguished by having no fore-teeth in either jaw. It includes the nine following kinds; rhinoceros, sukotyro, elephant, trichecus,—the morse, walrus, manate or lamantin, the dolphin of the poets of Greece and Rome, by whom it has been celebrated for its love of music, and perhaps not altogether without foundation;—the bradypus or sloth, the myrmecophagus or ant-eater, the manis or pangolin, the dasypus or armadillo, and the platypus or duck-bill, the ornithorhynchus, *paradoxus* of Blumenbach; that curious little quadruped which has hitherto only been discovered in Australasia, or the regions in and about New South Wales; and which seems to be a quadruped by its feet, a water-fowl by its bill, and an amphibial by its fondness for water. It is not yet quite certain whether this singular animal suckles its young, or has a mammary organ for this purpose; and if not, it must be discarded from its present situation, though we should be at no small loss to know where else to place it.

The THIRD CLASS of MAMMALS is denominated FERÆ or SAVAGE-BEASTS; and is distinguished by having, in every instance, fore-teeth, above and below, the number varying in different kinds, from two to ten; and in possessing a solitary tusk. The order comprises eleven kinds, the names of which are as follows: the phoca or seal, a water-quadruped, whose skin is so useful to us for various purposes; and which, like the stag, is found to shed tears when in trouble: the canis or dog-kind, including the numerous families of wolf, fox, jackal, hyæna: the felis or cat-kind, including a variety of tribes of a somewhat similar appearance, but far mightier, and nobler in their powers, as the lynx, the leopard, the panther, tiger, and lion, all of which have a power of climbing trees, though the weight of the larger species makes them do it very awkwardly, and only to a short height; all of which pitch on their feet in falling; and all of which see better in the night than by day: the viverra, including the ichneumon, and several of the weasels; the mustela, including other species of the weasels, the stoat, polecat, otter, ferret, sable and ermine; the two last of which we are indebted for the luxurious dresses that pass under their name. Almost all of the mustelas have a power of secreting and discharging a most fetid and intolerable stench at their will; and many of them do it as a mean of defence: and often so effectually that the very beast that pursues them is compelled to relinquish the chase, so completely is he overpowered by its noisome vapour. The remainder of this order are the ursus or bear; the didelphis or opossum; the marcopius or kangaroo, which is now naturalizing in the royal parks of our own country; the talpa or mole; the sorex or shrew; and the erinaceus or hedge-hog: which last is capable of being tamed, and is actually tamed by the Calmucs, and made a very useful domestic servant in destroying mice, toads, beetles, and other vermin.

The FOURTH ORDER of mammalian animals is denominated GLIRES, for which we may use the words HYBERNATERS, or BURROWERS. They are distinguished by having two fore-teeth in each jaw, close to each other, but remote from the grinders; and being without tusks. They all, in a greater or less degree, burrow in the earth, and almost all of them sleep through the whole, or a great part, of the winter. To this order, therefore, we can all of us, of our own accord, refer the ten following kinds, which are the whole that are included under it. The hystrix or porcupine; the cavia or cavy; the castor or beaver; the mus genus, comprehending the numerous families of the mouse and rat; the arctomys or marmot; the sciurus or squirrel, some of which have a long flying membrane that enables them to vault from tree to tree, like some species of the lemur; the myoxus or dormouse; the dipus or jerboa, whose form resembles the kangaroo, but whose habits the dormouse; the lepus, comprising the hare and rabbit tribes; and the hyrax or daman: with most of which we are too well acquainted to require any detailed account in so cursory a survey as the present.

The PECORA or CATTLE kinds form the next or FIFTH ORDER, and comprehend those horned quadrupeds which are most familiar and most useful to us. To this division, therefore, necessarily belong the bos, ovis, capra, and cervus kinds; or, in our own language, the ox, sheep, goat, and deer; and, as connected with these, in habits as well as in external appearance, the moschus, antilope, camelus—the musk, antelope, camel and camelopard, or giraffe. They are ordinarily distinguished by being without upper fore-teeth, but having six to eight in the lower jaw, remote from the grinders. They have all four stomachs, are hoofed, and have the hoof divided in the middle; and, except the camel, have two false hoofs, which, in walking, do not touch the ground. Such as have horns have no tusks, and such as have tusks have no horns: they ruminate or chew the cud; and from the torpid action of their multifid digestive canal, are apt to have balls form in different parts of it, owing to the frequent concretion of their food, occasionally intermixed, but more usually covered, with a quantity of hair, which they lick from their bodies. Some of these balls are of a whitish hue, and will bear a fine polish, and are known by the name of bezoards. These are chiefly the production of the antelope kind; and were formerly in very high estimation as amulets, and febrifuges.

The SIXTH ORDER of mammals embraces the BELUÆ or WARRIOR KINDS, possessing both upper and lower fore-teeth, and hoofed feet. The order consists of only four genera; the equus or horse, mule and ass tribes; the hippopotamus or river horse; the tapir, which in appearance and habits makes an approach to the river horse, but is smaller in size: and the numerous families of the sus or swine kind.

The LAST ORDER under the mammalian class consists of the CETE or WHALE KINDS, and embraces the monodon, sea unicorn or narwahl; balæna, common whale; physeter, cachalot, or spermaceti whale; and delphinus or dolphin, including as two of its species the phocœna or porpoise, the orca or grampus, and the dugong.

There is some force in introducing these sea-monsters into the same class with quadrupeds: but they are still continued here by M. Cuvier. They have a general concurrence of structure in the heart, lungs, backbone, and organ for suckling; but their teeth have little resemblance; and they have neither nostrils, feet, nor hair; instead of nostrils, possessing a spiracle or blowing-hole on the fore and upper-part of the head; and instead of feet, fins; in which, as well as in their general habits, manners, and residence in the waters, they have a close resemblance to fishes. These are chiefly inhabitants of the polar seas, and several of the larger species afford materials that are highly valuable as articles of commerce or manufactures. All of them produce a considerable quantity of blubber or the basis of the coarser animal oils; the common whale sometimes to as large a quantity as 6 or 8,000lb. weight: from the horny laminæ of whose upper jaw as well as from that of the balæna *Physalus* or fin-fish, we obtain also extensive layers of whalebone; while the cachalot supplies us with spermaceti from its head, and with ambergris from some of its digestive organs; a substance, however, only to be procured from such organs when the animal is in a state of sickness. The most warlike of the order is the grampus, which will often engage with a cachalot or a common whale of double its size, and continue the contest till it has destroyed it.

To this order also belongs the dugong or sea-cow of Sumatra, which has of late excited so much attention among naturalists. It was at one time supposed to be a hippopotamus or river-horse, but Sir Thomas Raffles has of late sufficiently proved it to be a cetaceous mammal. It is usually taken on the Malacca coast by spearing; its length is often from eight to nine feet. Its front extremities are two finny paddles; its only hind extremity is its tail, which is a very powerful instrument. It is never found on land or in fresh water, but generally in the shallows and inlets of the sea; the breasts of the adult females are of a large size, and especially during the time of suckling. Its food seems to consist entirely of fuci and submarine algæ, which it finds and browses upon at the bottom of the shallow inlets of the sea, where it chiefly inhabits. Its flesh resembles that of young beef, and is very delicate and juicy.*

In M. Cuvier's arrangement the class of mammals is entirely recast, and divided into three orders, or principal sections, as distinguished by claws or nails, by hoofs, or by fin-like feet; while the whole of these orders are further subdivided into eleven distinct families, of which the first six belong to the first order; the three next to the second; and the two last to the third.

The six families belonging to the first order, the nail or claw-footed, are these:

I. Bimanum: two-handed. Thumbs separate on the superior extremities only. Designed to include man alone.

II. Quadrumana: four-handed. Thumbs or great toes separate on each of the four feet. Monkeys and maucaucoes.

III. Sarcophaga: flesh-feeders. No separate thumbs or great toes on the anterior extremities. Bats, flying lemurs, hedge-hogs, shrews, moles, bears, weasels, civets, cats, including the lion and tiger-tribes; dogs, including the fox and wolf-tribes, and the opossums.

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* Phil. Trans. 1820, p. 174.

IV. Rodentia: gnawers. Want the canine teeth only. Cavies, beavers, squirrels, rats of all kinds.

V. Edentata: edentulate. Want both the incisive and canine teeth. Ant-eaters, pangolins, and armadillos.

VI. Tardigrada: slow-footed. Want only the incisive teeth. Sloth tribes.

The three families belonging to the second, or hoof-footed order, are the following.

VII. Pachydermata: thick-skinned. More than two toes; more than two hoofs. Elephants; tapirs, hogs, hippopotamus, rhinoceros, and hyrax or damon.

VIII. Ruminantia: ruminants. Two toes; two hoofs. Camels, musks, deer, giraffes, goats, sheep, oxen.

IX. Solipeda: single-hoofed. One toe, one hoof. Horse alone, including the ass-tribe.

The two families belonging to the third, or fin-footed order, are the following.

X. Amphibia: amphibials. Four feet. Seals, and morses. This family name should be changed, since the same term is also employed by M. Cuvier, after other naturalists, as the name of a distinct class of other animals.

XI. Cetacea: cetaceous. Feet fin-like. Manates or lamantins, dolphins, cachalots, whales, and narwhals.

We have thus run rapidly over a map of the different classes and kinds of animals as they are found extant in our own day. But those traced in a living state in our own day are by no means the whole that have existed formerly. In the lecture on Geology, in the preceding series,* we had occasion to observe that the various formations of rock, and especially the transition formations, open to us very numerous examples of whole families now no longer in existence; many of which have probably ceased to exist for several thousands of years; some of which indeed are so far removed from the races of the present day, as to require the invention of new genera, if not of new orders, in a zoological arrangement for their reception.

Stukeley, Lister, and other paleologists and naturalists of the last century, paid no small attention to this subject, and dragged forth the unrecognised relics of various animals from their fossil abodes: but it has since been pursued with extraordinary spirit and activity by the concurrent labours of Karg, Schlottheim, Fischer, Espen, Collini, Blumenbach, Humboldt, Werner, Buckland, and above all others, Cuvier; insomuch that the ascertained lost kinds bid fair in process of time to be almost as numerous as those that are living.

The last physiologist is well known to have formed a most valuable and extensive museum for the reception and arrangement of fossil animal remains; and so rich and varied in his possession, that he has commenced and made a considerable progress in a classification for systematically distinguishing them. The alluvial soil of our own country has furnished him with numerous examples; the shell-marl and peat-bogs of Ireland with one or two of still more striking character, and particularly with specimens, more or less perfect, of its enormous elk, one of the most celebrated of all the fossil ruminating animals. The Mediterranean coast,

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* Ser. I. Lect. VI.

Russia, and both Americas, have amply contributed to the collection. But it is to the limestone quarries of Æningen and Gaylenreuth, and the alternating quarries of Paris, that it is chiefly indebted for its very interesting supply of the animal remains of a former world.

We have not time to travel even over an outline of this wonderful repository. Those who have no opportunity of examining it on the spot, may be abundantly gratified by a perusal of M. Cuvier's valuable and extensive work on the fossil remains of quadrupeds :* which, though chiefly devoted to this particular class, is nevertheless rich in its history of extinct kinds and species of birds, amphibials, and fishes. We can only glance at a few of the more striking of the whole collection.

These are to be found chiefly in the class of mammals, and especially among the largest kinds. The gypsum formation of Paris, supposed to be a fresh-water deposite, has furnished M. Cuvier with two entirely original genera, and each genus with several species, the whole of which appear to be utterly extinct.

To these he has given the name of palæotherium and anoplotherium, or OLDEN-BEAST, in allusion to its existence in the olden times ; and DEFENCELESS BEAST, in allusion to the want of canine teeth in the genus it designates. Both genera belong to the Linnéan order of BELLUÆ or WARRIOR-BEASTS, and the Cuverian order of PACHYDERMATA or thick-skinned.

The station of the first is allotted in this order after the tapir, and before the rhinoceros and the horse, which gives us the best idea of its general character. It is generically distinguished by having forty-four teeth, in each jaw six fore-teeth, two incisors, fourteen molars : snout extended, flexible ; fore and hind-feet quadrifid.

The gypsum quarries alone have furnished five distinct species of this very singular animal, in a more or less perfect state of its skeleton,— 1. Palæotherium *magnum*, of the size of the horse. 2. P. *medium*, and 3. P. *crassum*, each of a size of the hog. 4. P. *curtum*, with decurtate, patulous feet. 5. P. *minus*, of the size of a sheep. Besides which, five other species have been discovered in other parts of France, imbedded in fresh water limestone, or in alluvial soil ; one of them, P. *giganteum*, as large as the rhinoceros ; and another, P. *tapiroides*, of the size of an ox.

The second species, or ANOPLOTHERIUM, is somewhat smaller, and has its station assigned between the rhinoceros or the horse on the one hand, and the hippopotamus, hog, and camel on the other. It has forty-four teeth in a continuous series : being, in each jaw, six fore-teeth ; two incisors, not longer than the fore-teeth ; fourteen molars ; fore and hind feet bifid, with distinct metacarpal and metatarsal bones ; and accessary digits in a few. This genus also offers four species, varying from the size of the horse or ass, to that of the leopard or elegant gazelle.

There is also another genus of entirely extinct quadrupeds, belonging to the same order, and of still larger magnitude, which M. Cuvier has been able to constitute, from remains found in different parts of the world, to which he has given the name of MASTODON. It makes a near approach to the elephant, and in one or two of its species vies with it in size. The ascertained species are five ; the largest of which, called the great mastodon, has been found in considerable abundance near the river Ohio ;

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* See also Mr. Kerr's Translation of M. Cuvier's Essay on the Theory of the Earth, with Professor Jameson's Notes, 8vo.—Edin.

and specimens of whose skeletons have been brought to our own country, and exhibited under the name of MAMMOTH, which, however, is an error; as mammoth is a Russian term, applied to a fossil species of genuine elephant, which we shall notice presently. But the mastodon has in America been confounded with the mammoth. Both have been dug up in the alluvial soil of Siberia. Of the other species, two have been discovered by M. Humboldt in America alone; one both in America and at Simorre in Europe; and one both in Saxony and Montabusard. They are all of less magnitude than the great mastodon; and, from the character of the teeth, there is no doubt that all the species were grazing animals.

The fossil elephant, to which I have just referred, the proper mammoth of natural history, makes a nearer approach to the Asiatic than to the African living species; but it, nevertheless, differs so much from both, as to leave no question of its being an entirely extinct animal. Various relics of it, as bones and teeth, have been found scattered over almost every part of Europe, as well as in Asia and both Americas; occasionally in our own island, in the isle of Sheppey, and in Ireland. But they are more common, and in a far more perfect state, in Sweden, Norway, Poland, and especially in Asiatic Russia; and M. Cuvier inclines to a belief that the bones of archbishop Pontoppidan's giants of the north are nothing more than remains of this animal. The most perfect specimen of this kind that has ever been met with, was discovered in the year 1799, by a Tungusian fisherman. It appeared at this time like a shapeless mass, projecting from an ice-bank near the mouth of a river in the north of Siberia. Year after year a larger and a larger portion of the animal was rendered visible by the melting of the ice in which it was imbedded: but it was not till five years after the first detection that its enormous carcass became entirely disengaged, and fell down from an ice-crag upon a sand-bank, on the coast of the Arctic Ocean. The greater part of its flesh was soon afterwards devoured by the white bear, or cut away by the Juhuts of the neighbourhood, as food for their dogs; yet when, in 1806, Mr. Adams examined it on the spot, and carefully collected all its remaining parts, more than thirty pounds weight of its hair and bristles were gathered from the wet sand-bank into which they had been trampled; and the mass of extremely thick and heavy skin, which was still left, demanded the utmost exertions of ten men for its removal.

The other extinct animals of the same class and order, collected or described by M. Cuvier, are a fossil rhinoceros, sufficiently distinguished from the only two species at present known; two unknown species of the hippopotamus; and two of the tapir.

Of the fossil rhinoceros, the earliest specimens noticed were those described by Grew, and consist of bones dug out of alluvial soil near Canterbury. Since which period, other relics have been traced in various parts of Germany, France, and Italy; while, in Siberia, an entire animal has been discovered, with its flesh and skin little injured. Of the two developed species of fossil hippopotamus, there is a doubt whether the largest, found in the alluvial soil of France and Italy, may not belong to an extant species; but the other, which is not larger than a hog, is strongly characterized, and widely different from either of the two living species of the present day. The two discovered species of fossil tapir evince a like difference of size, the one being small, the other gigantic: while both are found in different parts of France, Germany, and Italy.

All these belong to the pachydermatous or warrior-order of the mammal class, which may, perhaps, be regarded as the richest of all the divisions of fossil animals. But there is no class or order without like examples: and the caves of Gaylenreuth, on the frontiers of Bayreuth, as examined by Esper, have furnished quite as extensive a variety as the quarries around Paris. He has hence derived two entirely extinct species of bear, one of the size of the horse; several species of the dog; one of the cat; and two of the weazel; all of which are possibly extinct, though there is a doubt respecting one or two of them. In these caves alone, indeed, according to M. Esper, the enormous mass of animal earth, the prodigious number of teeth, jaws, and other bones, and the heavy grouping of stalactites, render the place a fit temple for the God of Death. Hundreds of cartloads of bony remains might be removed, and numerous bags be loaded with fossil teeth, almost without being missed.

The fossil deer and elk tribe form also a very numerous collection. Among these the celebrated elk of Ireland, dug out of a marl-pit near Drogheda, with its antlers of nearly eleven feet from tip to tip,* figures as chief. The finest fallow-deer, red-deer, roes and stags, belonging to the fossil kingdom, have been found in Scania, Sommes, Etampes, Orleans, or scattered over Europe, in limestone, peat-bogs, or sand-pits. M. Cuvier has described seven distinct species, all of which, with the exception of one, are extinct or unknown species. Of the fossil ox, buffalo, and antelope genus, he has given four distinct species, all apparently unknown.

He has also collected fossil remains of the horse and hog genera, without being able to ascertain to what species they belong: and various animals of the order glires or gnawers, as beavers, guinea-pigs, and rabbits, and two decidedly unknown species of the sloth tribe, which he has distinguished by the names of Megalonix and Megatherium, the first as large as an ox, earliest discovered in limestone caves in Virginia in 1796; and the second of the size of the rhinoceros, hitherto found only in South America. Specimens of the ox-sized have since been found in Buenos Ayres, in Lima, and in Paraguay; and of these three the first, a perfect skeleton, was sent as a present to M. Cuvier by the Marquis Loretto in 1789.

Relics of fossil seals and lamantins, though less perfect than most of the preceding, enter also into this extraordinary collection.

In the other classes M. Cuvier has hitherto made less progress; though his collection of fossil, and apparently unknown amphibials, especially of the crocodile and tortoise tribes, is considerable and highly interesting; and should his life be spared for ten or twelve years longer, we may have reason to expect these classes to be filled up as numerously as that of mammals.

Among the most extraordinary of the fossil amphibials he has enumerated, is the gigantic monster first discovered as early as the year 1766, in the limestone quarries at Maestricht, and which was at that time regarded by some naturalists as a whale, by others as a crocodile, and by a third set as an enormous unknown fish. M. Cuvier has sufficiently ascertained that it must have formed an intermediate genus between those animals of the lizard tribe which possess a long and forked tongue, and those with a short tongue and a palate armed with teeth; and it is hence generally regarded in the present day as a MONITOR, making an approach towards the crocodile. The length of the skeleton seems to have been about twenty-four feet: the head is a sixth part of the whole length of the animal, which is nearly the proportion it bears in the crocodile. The tail must have been very strong, and its width at the extremity to have rendered it a most powerful oar, capable indeed of opposing any violence of the waters; and it is hence chiefly that M. Cuvier regards it as having been an inhabitant of the ocean: though we are hereby put into possession of a kind or species far surpassing in size and power any of those which it most nearly resembles, and at least rivalling the magnitude of the crocodile.*

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* See Sir Thomas Molyneux's account of this animal in Phil. Trans. 1726.

This is the Cervus *Eurycerus* of Dr. Hibbert: a name he has applied to it from Aldrovandus, who appears to have been acquainted with this species of fossil elk, and has referred to it as common at that time in various soils in the British Isles. Specimens, indeed, are still often to be met with in this quarter: and Dr. Hibbert, in the essay now referred to, quotes part of a letter from Dr. Milligan, of Edinburgh, in which he adverts to the skeletons of three great elks that were lately dug up in Ireland, one of which measures eleven feet between the tips of the horns. And he adds, what would seem to show that this species had not been many ages extinct, that near them, in a three feet stratum of marl, were also found the skeletons of three dogs; and, at a little distance, several human skeletons. Edin. Journ. of Science, No. V. p. 134. 1825.

The circumstances under which most of the preceding large and fossil animals have been found, and especially those traced in Siberia, afford sufficient proof that the catastrophe which arrested them must have overtaken them suddenly, while in their native regions; and that they could not have been brought into their present situations from a remote distance. And we have hence facts to show, as we had occasion to observe formerly, that various quadrupeds of the largest size, as the elephant, mammoth, rhinoceros and hippopotamus, which are now traced in a living state in the hot parts of Asia, Africa, or America alone, formerly existed, as to certain species that have been long extinct, in the highest northern latitudes: and that consequently such species must have had such a discrepancy of habit and organization, like the dog and the ox tribes of our own day, as enabled them to endure the difference.

Such then is a brief sketch, I will not say of the animal kingdom, but of the most popular arrangements which have hitherto been attempted concerning it. It would have been much easier, and might have been much more interesting, to have extended the survey: but the thread of connexion would then, probably, have escaped from us, and we should have lost the system in the fulness of the description.

Enough, however, and more than enough has, I trust, been offered to prove that the study of zoology is of a most interesting and inviting character, equally calculated to win the heart, and to inform the head. I have dwelt somewhat more at large upon the three lowest classes of worms, insects, and fishes, for the very reason that these classes have too often been passed over by naturalists as little worthy of their attention; and because I wished to impress upon your minds, by the incontrovertible fact of living examples, that nothing is low, nothing little, nothing in itself unworthy in the view of the great Creator and common parent of the universe; that nothing lies beyond the reach of his benevolence, or the shadow of his protection. God alike supplies the wants and ministers to the enjoyments of every living creature: he alike finds them food in rocks and in wildernesses, in the bowels of the earth, and in the depths of the ocean. His is the wisdom that, to different kinds and in different ways, has adapted different habits and modes of being; and has powerfully endowed with instinct where he has strikingly restrained intelligence. It is he that has given cunning where cunning is found necessary, and wariness where caution is demanded; that has furnished with rapidity of foot, or fin, or wing, where such qualities appear expedient; and where might is of moment, has afforded proofs of a might the most terrible and irresistible.

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* The fossil animals of this class have been since considerably enlarged by other discoveries; among the most curious of which, perhaps, are the Plesiosaurus of the late Mr. Conybeare, and the Megalosaurus of professor Buckland. The remains of the last are the most imperfect; though from a large portion of the lower jaw dug up from the soil at Stonesfield, near Oxford, and a thigh bone, found at Cuckfield, in Sussex, Mr. Buckland has been able to ascertain its mode of dentition, as also to estimate that its face must have terminated in a flat, straight, and very narrow snout. Its length seems to have been upwards of sixty feet, and its bulk to have equalled that of an elephant seven feet high. *Geol. Trans.* Series II. Vol. I. Part II.

The structure of this genus makes an approach to that of fishes, but it has a length and flexibility of neck like that of the larger birds; and from the form of its paddles, it is probable that, like the crocodile, it swam on the surface of the ocean; an idea which is confirmed by various specimens found on the Dorsetshire coast, where the present writer has seen one or two nearly entire specimens.

At the head of the whole stands man, the noblest monument of creative power "in this diurnal scene," and, in a state of purity and innocence, a faint image of the Creator himself; connected with the various classes of animals by his corporeal organization, but infinitely removed from them by the possession of an intelligent and immortal spirit; his chief distinction, to the external eye, consisting in the faculty of language, and the means of communicating and interchanging ideas:—a subject full of interest and of importance, and towards which, therefore, I shall beg leave to direct your attention after we have examined this lord of the universe in the different varieties he exhibits in different parts of the world, under the influence of climate, manner of life, and incidental circumstances.

> Thus nature varies: man, and brutal beast,
> And herbage gay, and scaly fishes mute,
> And all the tribes of heaven, o'er many a sea,
> Through many a grove that wing, or urge their song
> Near many a bank or fountain, lake or rill:
> Search where thou wilt, each differs in his kind,
> In form, in figure differs.*

LECTURE III.

ON THE VARIETIES OF THE HUMAN RACE.

Thus far we have confined ourselves to the different classes of animals below the rank of man. The sketch has been rapid and unfinished, but I hope not altogether unfaithful, or without its use. Let us now proceed to a general survey of the human species; the generic character by which man is distinguished from other animals, and the family character by which one nation is distinguished from another nation.

If we throw an excursive glance over the globe, and contemplate the different appearances of mankind, in different parts of it, and especially if we contrast these appearances where they are most unlike, we cannot but be struck with astonishment, and feel anxious for information concerning the means by which so extraordinary an effect has been produced. The height of the Patagonian and the Caffre is seldom less than six feet, and it is no uncommon thing to meet with individuals among them that measure from six feet seven to six feet ten; compared with these, the Laplanders and Eskimaux are real dwarfs; their stature seldom reaching five feet, and being more commonly only four. Observe the delicate cuticle, and the exquisite rose and lily that beautify the face of the Georgian or Circassian: contrast them with the coarse skin, and greasy blackness of the African negro, and imagination is lost in the discrepancy. Take the nicely-turned and globular form of the Georgian head, or the elegant and unangular oval of the Georgian face: compare the former with the flat skull of the Carib; and the latter with the flat visage of the Mogul Tartar, and it must, at first sight, be difficult to conceive that each of these could have proceeded from one common source. Yet the diversities of the intellectual powers are, perhaps, as great as those of the corporeal: though I am ready to admit, that for certain interested purposes of the worst and wickedest description, these diversities, for the last half century, have, even in our own country, been magnified vastly beyond their fair average, though the calumny has of late begun to lose its power.

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* Præterea genus humanum, mutæque natantes
Squamiferum pecudes, et læta armenta, feræque,
Et variæ volucres, lætantia quæ loca aquarum
Concelebrant, circum ripas funtisque, lacusque;
Et quæ pervolgant nemora avia pervolitantes;
Quorum unum quod vis generatim sumere perge,
Ivenies tamen inter se differre figuris.
De Nat. Rer. II. 842.

The external characters thus glanced at, form a few of the extreme boundaries: but all of them run into each other by such nice and imperceptible gradations in contiguous countries, and sometimes even among the same people, as to constitute innumerable shades of varieties, and to render it difficult, if not impossible, to determine occasionally to what region an individual may belong when at a distance from his own home.

It has hence been necessary to classify the human form; and the five grand sections, for we can no longer call them quarters, into which the globe is divided by the geographers of our own day, present us with a system of classification equally natural and easy: for in each of these sections we meet with a marked distinction, a characteristic outline that can never be mistaken, except in the few anomalies already adverted to, and which belong to almost every general rule; or in instances in which we can obviously trace an intermixture of aboriginal families.

Before we attempt, then, to account for these distinctions, let us endeavour, as briefly as possible, to point them out; and consider them under the five heads of the

European race;
Asiatic race;
American race;
African race;
Australian race;

or as they are denominated by M. Blumenbach, in his excellent work upon this subject,* the Caucassian, Mongolian, American, Ethiopian, and Malay varieties.

Gmelin has pursued the same general divisions, but has merely distinguished the respective races; and accordingly his five definitions are the white, brown, copper-coloured or red, black, and tawny man.

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* De Generi Humani Varietate Nativa.

I. The most symmetrical, and therefore the most elegant variety of the human form, is that which I have called the EUROPEAN, in consequence of its being traced in the European division of the globe more largely than in any other; and the most perfect lineaments of this variety are those of the region of Asia Minor, on the borders of Europe, the parent spot from which it has been imported—lineaments which we find distributed among the Georgians, Circassians, Mingrelians, Armenians, Persians, and other nations that skirt the southern foot of the vast chain of the Caucasus. And it is on this account that M. Blumenbach has given the name of the CAUCASIAN variety to the European form in general. It is remarkable that in this spot of the globe man was first created: here he first received the breath of life, and arose in the image of his Maker. The die has not yet lost its divine impress: for here we still meet, and in all ages have met (so far as relates to the exterior graces) with the most exquisite models of symmetry and beauty.

The general colour of the EUROPEAN or GEORGIAN variety, the WHITE division of Gmelin, is fair; that of the cheeks more or less red; the head globular; the face straight and oval, with the features moderately distinct: the forehead slightly flattened; the nose narrow, and slightly aquiline; the cheek-bones unprominent; the mouth small; the lips a little turned out, especially the under one; the chin full and rounded; the eyes and hair variable, but the former, for the most part, blue, and the latter yellow, or brown and flowing.

II. The colour of the ASIATIC, or MONGOLIAN, the BROWN-MAN of Gmelin, is yellowish brown or olive, with scarcely ever an appearance of red in the cheeks, which seems to be confined to the European variety; the head, instead of being globular, is nearly square; the cheek-bones wide; and the general face flat; the eyes are black and small; the chin rather prominent; and the hair blackish and scanty.

III. The AMERICAN, or RED-MAN of Gmelin, is of an obscure orange, rusty-iron, or copper-colour; the head is less square, the cheek-bones less expanded, and the face less flattened than in the Asiatic; the eyes are deeply seated; and the hair is black, straight, and thick. This variety seems to form a middle point between the European and the Asiatic.

IV. The colour of the AFRICAN, the ETHIOPIAN of Blumenbach, and BLACK-MAN of Gmelin, varies from a deep tawny to a pitch or perfect jet. The head is narrow; the face narrow, projecting towards the lower part; the forehead arched; the eyes projecting; the nose thick, almost intermixed with the cheeks; the lips, particularly the upper one, very thick, the jaws prominent; the chin retracted; the hair black, frizzled, and woolly. The countenance in this variety recedes farther, than in any other, from the European, and approaches much nearer, than in any other, that of the monkey.

V. The AUSTRALIAN, or inhabitants of New South Wales, and the numerous clusters of islands that begirt that prodigious range of unexplored country, together with the South Sea Islands in general, constituting the MALAY of Blumenbach, and the TAWNY-MAN of Gmelin, is of blackish-brown, or mahogany colour: the head is somewhat narrowed at its upper part; the forehead somewhat expanded; the upper jaw slightly prominent; and the nose broad, but distinct; the hair harsh, coarse, long, and curly. This variety seems to form a middle point between the European and the African; as the American does between the

European and the Asiatic. So that, in a more compendious view of the human race, we might contract the five varieties into three:—the European, Asiatic, and African; and regard the other two as mere intervening shades of variety.

In this general classification of mankind, however, there are two observations that are peculiarly worthy of attention. The first is, that although these distinctive characters will hold in the main, it is not to be expected that they will apply to every individual of the particular division to which they refer; nor that they belong so exclusively to such division as never to be traced, even by a natural introduction, among other divisions. The second is, that from the restless or inquiring spirit of several of the divisions, and the migrations which have hence ensued, we ought to expect to meet occasionally with the distinctive characters of such divisions among other divisions, and in regions to which they do not naturally appertain.

A perfect jet of the skin has never, perhaps, been found in our own country, in any person of genuine English race; but a dark, swarthy, and even copper-colour is by no means uncommon; and an equal difference is observable in the globularity of the head, and the flatness or sharpness of the face. In like manner the skin is occasionally found fair among the red tribes of America;* and black among the tawny tribes of Australia, and even the olive nations of India. So Captain Cook informs us that, among the natives of the Friendly Islands, he saw hundreds of European faces, and not a few genuine Roman noses. And Adanson asserts that he was struck with the general beauty and proportion of several Senegambian females, in spite of their colour: while Vaillant and Le Maire give a similar testimony concerning the Caffre women, and the negresses of Gambia and Senegal.

The most inquiring and consequently the most migratory of the five divisions under which we are contemplating the race of man, is unquestionably the European. And hence we have reason to expect that we shall meet with more numerous establishments of the European form in regions to which it does not naturally belong than of any of the others, and experience confirms this expectation. It is, in truth, the migratory spirit of this peculiar division that has filled Europe itself; for, as I have already had occasion to remark, the division in its earliest state was confined to the southern foot of the Caucasus, and branched out into Europe from this region. And thus, in the west of Africa, extending from Fez to the Zaāra, we discover considerable patches of the same lineage, the progenitors of which have either shot through the isthmus of Suez or crossed the Mediterranean; while every one knows that, from a similar spirit of migration, America both North and South, and India, in its southern promontory of the Deccan, have for several centuries past exhibited patches of a similar kind.

The Asiatic race, properly so called, have in like manner had their migrations; and hence we trace the form and features of this family, spreading southerly through the whole of Egypt and Abyssinia; northerly from the Imaus or Caff of the Caucasus towards the arctic boundaries of Europe and America, amidst the Laplanders and Nova Zemblians of the former, and the Greenlanders and Iskimos or (as we have it from the French writers) Esquimaux of the latter; and westerly from the north of Persia along the banks of the Euxine, in successive waves, and chiefly under the different denominations of Fins, Goths, Alans, and Huns; the two last uniting on various occasions, and especially under the triumphant banners of Attila, and overrunning great part of Germany, and consequently intermixing with the European race; at the same time driving the Fins into higher northern latitudes, along the shores of the Baltic, where they at length intermingled with the Laplanders. Among both these nations therefore, whether blended or separate, we still meet with very strong marks of the true, genuine Asiatic face, flat, wide, and of a sallow or olive hue; the eyes being small, and the hair dark and scanty.

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* See M. Humboldt; Essai Politique sur le Royaume de la Nouvelle Espagne. Paris, 1808—1809.

It is probable, also, that the more polished nations of America, as the Toltecs and Mexicans that belong to the northern, and the Peruvians and Araucans that belong to the southern division of this continent, have originated from an Asiatic source. De Guignes, Forster, and Humboldt, concur in believing them to have been of Chinese or Japanese descent; while the mass of the numerous tribes that constitute the chief population of this continent, and are altogether distinguished in external and internal character from the preceding nations, seems to have issued, in various migrations, from some of the red or copper-coloured tribes with lank hair, which have of late years been traced in particular parts of Africa. It is also probable that Australia has in like manner been peopled by successive waves of rovers from both these continents; for we trace proofs of both sources, sometimes separate, and sometimes mixt. But the theories that have been offered upon this subject are too numerous, and for the most part too fanciful for a minute detail, and belong rather to the geographer than to the physiologist.

There are some philosophers who have assigned several other distinctive characters to the different families of mankind than any thus far dwelt upon; and which are chiefly derived from the stature, the shape of a particular limb, or the intellect; thus the gigantic height of the Patagonian has been adverted to as a very prominent feature; the pigmy form of the Esquimaux; and the still more pigmy form of the Kimos of Madagascar, if any reliance may be placed on the testimony of Commerson, now that it has been corroborated by Modave, and still more lately by the Abbé de Rochon; the curved leg of the Calmuc race; the long leg of the Indian; and the high calf and flat foot of the Ethiopian. But it appears to me that all such distinctions are upon too narrow a scale, and perhaps too much dependent upon particular circumstances, for an admission into the lines of a broad and original demarcation. To the different powers of the intellect, which are still less to the point than even these corporeal peculiarities, I shall have occasion to advert presently.

Omitting, then, the consideration of these subordinate points, whence have proceeded those striking and far stronger characteristics which we have noticed in the preceding divisions? Are the different distributions of man mere varieties of one common species, or distinct species merely connected under an imaginary genus? Has the human race proceeded from one source or from many?

In a country professing the Christian religion, and appealing to the records of Moses, as an established and veritable authority, I ought, perhaps, to blush at proposing such a question in public: but the insinuations which have in various ways been thrown out against this authority demand it, and

I hasten to rescue, so far as I am able, the first and most interesting account we possess of the creation of man, from the philosophical doubts which have been thrown upon it, and to reconcile it with the natural history of man in our own day.

The Mosaic statement has met with two distinct classes of opponents, each of which has pretended to a different ground of objection. The one has regarded this statement as altogether untrue, and never intended to be believed; as a mere allegory or fiction;—a beautiful mythos often indulged in by other oriental writers in the openings of their respective histories:—as an enlivening frontispiece to a book of instruction. The other class has been in some degree more guarded in its attack; and has rather complained that the statement is inexplicit than that it is untrue. These last philosophers have found out that in its common interpretation it does not accord with the living volume of nature; and they hence contend that the common interpretation is incorrect; they perceive or think they perceive a variety of chasms in the sacred text which it is necessary to fill up before it can be made to harmonize with natural facts and appearances.

At the head of the former class stand the names of some of the first natural historians and scholars of modern times, as Linnéus, Buffon, Helvetius, Monboddo, and Darwin. And from whom do these philosophers, thus departing from the whole letter and spirit of the Mosaic history, pretend to derive the race of man? The four former from the race of monkeys; and the last to complete the absurdity, from the race of oysters; for Dr. Darwin seriously conjectures that as aquatic animals appear to have been produced before terrestrial, and every living substance to have originated from a form or nucleus exquisitely simple and minute, and to have been perpetually developing and expanding its powers, and progressively advancing towards perfection, man himself must have been of the aquatic order on his first creation: at that time, indeed, imperceptible from his exility, but in process of years, or rather of ages, acquiring a visible or oyster-like form, with little gills, instead of lungs, and, like the oyster, produced spontaneously, without distinction into sexes; that, as reproduction is always favourable to improvement, the aquatic or oyster mannikin, by being progressively accustomed to seek its food on the nascent shores or edges of the primæval ocean, must have grown, after a revolution of countless generations, first into an amphibious, and then into a terrestrial animal; and, in like manner, from being without sex, first also into an androgynous form, and thence into distinct male and female.*

It is not necessary to notice this dream of a poetizing philosopher, which had also been dreamt of long before his own day, any further than to remark that it is in every respect inferior to the opinion of two of the most celebrated schools of ancient Greece, the Epicurean and the Stoic; who, though they disagreed on almost every other point, concurred in their dogma concerning the origin of man; and believed him to have sprung, equally with plants and animals of every kind, from the tender soil of the new-formed earth, at that time infinitely more powerful and prolific; produced in myriads of little wombs that rose, like mole-hills over the surface of the ground, and were afterwards transformed, for his nourishment, into myriads of glandular and milky bulbs, so as to form a marvellous substitute for the human-breast.

In the correct and elegant description of Lucretius:—

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* See Temple of Nature, Cant. I. p. 26. 29., II. p. 54. IV. 158., and the additional notes on Spontaneous Vitality and Reproduction.

Terra cibum pueris, vestem vapor, herba cubile
Præbebat, multa et molli lanugine abundans.*

Earth fed the nursling, the warm ether clothed,
And the soft downy grass his couch composed.

And frivolous as such a theory may appear in the present day, it was the only one which was current among the Grecian or Roman philosophers, except that which supposed mankind to have been propagated by eternal generation, and of course the universe, like himself, to be eternal and self-existent: compared with which, an origin from the dust of the earth, even after the manner of vegetables, is incomparably less monstrous and absurd.

Let us now pass on to the hypothesis of those modern philosophers who would associate the tribes of man with the tribes of the monkey, and originate both from one common stock, in the same manner as the ox and the buffalo are said to be derived from the bison, and the different varieties of sheep from the argali.

There are a few wonderful histories afloat of wild men and wild women found in the woods of Germany and France; some of which are said to have been dumb, others to have the voice of sheep or oxen, and others again to have walked on all-fours. And from these few floating tales, not amounting, in modern times, to more than nine or ten, Linnéus thought proper to introduce the orang-otang into the human family, and to regard such instances of wild men as the connecting species between this animal and mankind in a state of civilized society. Whence Lord Monboddo has amused us with legends of men found in every variation of barbarism; in some instances even ungregarious or solitary; in others, uniting, indeed, into small hordes, but so scanty even in natural or inarticulate language, as to be obliged to assist their own meaning by signs and gestures; and, consequently, to be incapable of conversing in the dark; of a third sort, who have in some degree improved upon their natural language, but have still so much of the savage beast belonging to them, as to employ their teeth and nails, which last are not less than an inch long, as weapons of defence; and of a fourth sort, found in an island of the Indian Seas, with the full possession of speech, but with tails like those of cats or monkeys; a set of dreadful cannibals, which at one time killed and devoured every Dutchman they could lay their hands upon.

It is truly wonderful, that a scholar of Lord Monboddo's accomplishments could have allowed himself to be for one moment imposed upon by a mass of trash so absurd and extravagant as not to be worth the trouble of confuting. Such romances are certainly in existence; but they are nothing more than the fabled news of a few low and illiterate mariners, whose names were never sufficient to give them the slightest degree of authority, even when they were first uttered; and which, for the most part, dropped successively into an obscure and ignominious grave at the moment of their birth, and would have silently mouldered away into their elemental nothingness, had not this very singular writer chosen to rake up their decomposing atoms, in order to support an hypothesis which sufficiently proves its own weakness by the scouted and extravagant evidence to which it is compelled to appeal.

Of the wild men and wild women of Linnéus, some appear to have been idiots, escaped from their keepers; a few, exaggerated accounts of stray children from some wretched hovel of Lithuanian peasants ; and one of them a young negress, who during a shipwreck on the French coast, had swam on shore, and at once saved herself from death, and, what is worse than death, from slavery. She is said to have been found in the woods of Champagne, about the middle of the last century, and was at first exhibited under the name of *la fille sauvage* and *la belle sauvage ;* and had the honour, soon afterwards, of being painted as a sign-post to one of our most celebrated inns in this metropolis, which is still known by the name of the *Bell Savage.* This young negress was instructed in the French language by the family into whose hospitable hands she fell, and was afterwards, from some unaccountable whim, denominated Mademoiselle LE BLANC.*

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* De Rer. Nat. v. 803.

In order, however, to settle this question completely, let me mention a few of the anatomical points in which the orang-otang differs from the human form, and which cannot possibly be the effect of a mere variety, but must necessarily flow from an original and inherent distinction. More might be added, but what I shall offer will be sufficient ; and if I do not touch upon a comparison of the interior faculties, it is merely because I will neither insult your understandings nor degrade my own, by bringing them into any kind of contact.

Both the orang and pongo, which of all the monkey tribes make the nearest approach to the structure of the human skeleton, have three vertebræ fewer than man. They have a peculiar membranous pouch connected with the larynx or organ of the voice, which belongs to no division of man whatever, white or black. The larynx itself is, in consequence of this, so peculiarly constructed as to render it less capable even of inarticulate sounds than that of almost every other kind of quadruped ; and, lastly, they have no proper feet ; for what are so called, are, in reality, as directly hands as the terminal organs of the arms : the great toe in man, and that which chiefly enables him to walk in an erect position, being a perfect thumb in the orang otang. Whence this animal is naturally formed for climbing ; and its natural position in walking, and the position which it always assumes excepting when under discipline, is that of all-fours ; the body being supported on four hands, instead of on four feet as in quadrupeds. And it is owing to this wide and essential difference, as, indeed, we had occasion to observe in our last study, that M. Cuvier, and other zoologists of the present day, have thought it expedient to invent a new name by which the monkey and maucauco tribes may be distinguished from all the rest ; and, instead of QUADRUPEDS, have called them QUADRUMANA, or QUADRUMANUALS ; by which they are at the same time equally distinguished from every tribe of the human race, which are uniformly, and alone, BIMANUAL.

But throwing the monkey kind out of the question, as in no respect related to the race of man, it must at least be admitted, contend the second class of philosophers before us, that the wide differences in form, and colour, and degree of intellect, which the several divisions of mankind exhibit, as you have now arranged them, must necessarily have originated from different sources ; and that even the Mosaic account itself will afford countenance to such an hypothesis.

This opinion was first stated, in modern times, by the celebrated Isaac Peyrere, librarian to the Prince of Condé ; who, about the middle of last century, contended, in a book which was not long afterwards condemned to the flames, though for other errors in conjunction with the present, that the narration of Moses speaks expressly of the creation of two distinct species of man :—an elder species which occupied a part of the sixth day's creation, and is related in the first chapter of Genesis ; and a junior, confined to Adam and Eve, the immediate progenitors of the Hebrews to whom this account was addressed ; and which is not referred to till the seventh verse of the second chapter, and even then without any notice of the exact period in which they were formed. After which transaction observe this writer and those who think with him, the historian confines himself entirely to the annals of his own nation, or of those which were occasionally connected with it. Neither is it easy, they adjoin, to conceive, upon any other explanation, how Cain, in so early a period of the world as is usually laid down, could have been possessed of the implements of husbandry which belonged to him ; or what is meant by the fear he expressed, upon leaving his father's family, after the murder of Abel, that every one who found him would slay him : or, again, his going forth into another country, marrying a wife there, and building a city soon after the birth of his eldest son.

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* See Monboddo on the Origin of Language, &c. vol. i. p. 193. 480.

Now, a cautious perusal of the Mosaic narrative will, I think, incontestably prove that the two accounts of the creation of man refer to one and the same fact, to which the historian merely returns, in the seventh verse of the second chapter, for the purpose of giving it a more detailed consideration ; for it is expressly asserted in the fifth, or preceding verse but one, as the immediate reason for the creation of Adam and Eve, that at that " time there was not a man to till the ground ;" while, as to the existence of artificers competent to the formation of the first rude instruments employed in husbandry, and a few patches of mankind scattered over the regions adjoining that in which Cain resided, at the period of his fratricide, it should be recollected that this first fall of man by the hand of man, did not take place till a hundred and twenty-nine years after the creation of Adam : for it was in his one hundred and thirtieth year, that Seth was given to him in the place of Abel : an interval of time amply sufficient, especially if we take into consideration the peculiar fecundity of both animals and vegetables in their primæval state, for a multiplication of the race of man, to an extent of many thousand souls.

On such a view of the subject, therefore, it should seem that the only fair and explicit interpretation that can be given to the Mosaic history is, that the whole human race has proceeded from one single pair, or in the words of another part of the Sacred Writings, " that God hath made of ONE BLOOD all nations of men for to dwell on all the face of the earth."* The book of Nature, is in this, as in every other respect, in union with that of Revelation : it tells us that one single pair must have been adequate to all the purposes on which this class of philosophers have grounded their objections : and it should be further observed to them, that thus to multiply causes without necessity, is not more inconsistent with the operations of nature, than with the principles of genuine philosophy.

But the question still returns : whence, then, proceed those astonishing diversities among the different nations of mankind, upon which the arrangement now offered is founded ?

The answer is, that they are the effect of a combination of causes ;

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*Acts, xviii. 26.

some of which are obvious, others of which must be conjectured, and a few of which are beyond the reach of human comprehension :—but all of which are common to other animals, as well as to man ; for extraordinary as these diversities may appear, they are equally to be met with in the varieties of several other kinds of animals that can be proved to have been produced from a single species, and, in one or two instances, from a single pair.

The chief causes we are acquainted with are the four following : climate, food, manner of life, and hereditary diseases.

I. The influence which CLIMATE principally produces on the animal frame is on the colour of the skin and on the extent of the stature. All the deepest colours we are acquainted with are those of hot climates ; and all the lightest those of cold ones. In our own country we perceive daily, that an exposure to the rays of the sun turns the skin from its natural whiteness to a deep brown or tan ; and that a seclusion from the sun keeps it fair and unfreckled. In like manner the tree-frog (rana *arborea*) while living in the shade is of a light yellow, but of a dark green when he is obliged to shift from the shade into the sun-shine. So the nereis *lacustris*, though whitish under the darkness of a projecting bank, is red when exposed to the sun's rays. And that the larves of most insects that burrow in the cavities of the earth, of plants, or of animals, are white, from the same cause, is clear, since being confined under glasses that admit the influence of solar light, they exchange their whiteness for a brownish hue.

The same remark will apply to plants as well as to animals ; and hence nothing more is necessary to bleach or whiten them, than to exclude them from the light of day. Hence the birds, beasts, flowers, and even fishes of the equatorial regions, are uniformly brighter or deeper tinctured in their spots, their feathers, their petals, and their scales, than we find them in any other part of the world. And hence, one reason at least for the deep jet which, for the most part, prevails among mankind under the equator ; the dark-brown and copper-colours found under the tropics ; and the olive, shifting through every intermediate shade to the fair and sanguine complexion, as we proceed from the tropic of Cancer northwards. Hence, too, the reason why the Asiatic and African women, confined to the walls of their seraglios, are as white as Europeans ; why Moorish children, of both sexes, are, at first, equally fair, and why the fairness continues among the girls, but is soon lost among the boys.

As we approach the poles, on the contrary, we find every thing progressively whiten ; bears, foxes, hares, falcons, crows, and black-birds, all assume the same common livery ; while many of them change their colour with the change of the season itself. For the same reason, as also because they have a thinner mucous web, the Abyssinians are less deep in colour than the negro race ; for though their geographical climate is nearly the same, their physical climate differs essentially : the country stands much higher, and its temperature is far lower.

The immediate matter of colour, as I had occasion to observe more fully in a preceding lecture, is the mucous pigment which forms the middle layer of the general integument of the skin ; and upon this, the sun, in hot climates, appears to act in a twofold manner ; first, by the direct affinity of its colorific rays with the oxygene of the animal surface, in consequence of which the oxygene is detached and flies off ; and the carbone and hydrogene being set at liberty, form a more or less perfect charcoal according to the nature of their union ; and next, by the indirect influence which its calorific rays, like many other stimulants, produce upon the liver, by exciting it to a secretion of more abundant bile, and of a deeper hue. I have formerly remarked that this second or colouring layer of the general integument of the skin, differs (as indeed all the layers of the skin do) in their thickness, not only in different kinds of animals, but very frequently in different species, varieties, and even individuals. Thus in our own country we find it more abundant in some persons than in others; and wherever it is most abundant, we find the complexion also of a darker and coarser, and greasier appearance, upon a common exposure to the solar light and heat; and we find also, that the hair is almost uniformly influenced by such increase of colour, and is proportionably coarser and darker.

It is of some consequence to attend to this observation; for it may serve to explain a physiological fact that has hitherto been supposed of difficult elucidation.

A certain degree of heat, though less than that of the tropics, appears favourable to increase of stature; and I have already observed, that the tallest tribes we are acquainted with are situated at the back of Cape Horn, and the Cape of Good Hope. On the contrary, the most diminutive we are acquainted with are those that inhabit the coldest regions or the highest mountains in the world: such are the Laplanders and Nova Zemblians in Europe, the Samoieds, Ostiacs and Tongooses in Asia, and the Greenlanders and Eskimaux in America. Such, too, are the Kimos of Madagascar, if the account of these pigmy people may be depended upon, whose native region is stated to be the central and highest tracts of the island, forming, according to Commerson, an elevation of not less than sixteen or eighteen hundred fathoms above the level of the sea.

A multitude of distinct tribes have of late years been discovered in the interior of Africa, in the midst of the black tribes, exhibiting nothing more than a red or copper hue, with lank black hair. And, in like manner, around the banks of the lower Orinoco, in Mexico, where the climate is much hotter, there are many clans of a much lighter hue than those around the banks of the Rio Negro, where it is much cooler; and M. Humboldt has hence ventured to assert that we have here a full proof that climate produces no effect upon the colour of the skin. Such an assertion, however, is far too hasty; for he should first have shown that the thickness of the mucous web or colouring material is equally abundant in all these instances. For if it be more abundant (as it probably is) in the tribes that are swarthiest, we have reason to expect that a swarthier colour will be found where there is an equal or even a less exposure to solar light and heat; and we well know that the hair will vary in proportion.*

II. The effects of DIFFERENT KINDS OF FOOD upon the animal system are as extensive and as wonderful as those of different climates. The fineness and coarseness of the wool or hair, the firmness and flavour of the flesh, and in some degree the colour of the skin, and extent of the stature, are all influenced by the nature of the diet. Oils and spirits produce a peculiar excitement of the liver: and like the calorific rays of the sun, usually become the means of throwing an overcharge of bile into the circulation. Hence the sallow and olive hue of many who unduly addict themselves to vinous potation, and who at the same time make use of but little exercise. And hence also the dark and dingy colour of the pigmy people inhabiting high northern latitudes, to whom we have just adverted, and whose usual diet consists of fish and other oils, often rancid and offensive. Though it must be admitted that this colour is in most instances aided by the clouds of smoke in which they sit constantly involved in their wretched cabins, and the filth and grease with which they often besmear their skins. And hence also one cause of their diminutive stature; the food they feed on being unassimulating and innutritive. Swine and all other animals fed on madder-root, or that of gallium *verum*, or yellow-ladies-bed-straw, have the bones themselves tinged of a deep red, or a yellow; and M. Huber of Lausanne, who has of late years made so many valuable discoveries in the natural habits of the honey-bee, has proved himself able by a difference in the food alone, as indeed Debraw had done long before him,* to convert what is commonly, but improperly, called a neuter into a queen bee.

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* See Essai Politique sur la Nouvelle Espagne, par Alexandre de Humboldt, &c. pp. 84. 85. 4to. Paris, 1808, 1809.

III. It would be superfluous to dwell on the changes of body and perceptive powers produced in the animal system, by a DIFFERENCE IN THE MANNERS AND CUSTOMS. We have the most striking proofs of this effect in all the domesticated animals by which we are surrounded. Compare the wild horse with the disciplined; the bison with the ox, which last is usually regarded as the bison in a state of tameness; and the Siberian argali with the sheep which is said to have sprung from it. Compare the modern Romans with the ancient; the low cunning and servile temper of too many of the Greek tribes of the present day, that still bend to and kiss the Ottoman rod, with the noble courage and patriotic enthusiasm of their forefathers, who drove back the tyrant of Persia and his million of men across the Hellespont, and dashed to pieces the proud bridge with which he boasted of having conquered the billows.

It is in reality from long and deeply rooted habit alone that the black, red, and olive colour of the Ethiopian, American, and Moguls, is continued in the future lineage for so many generations after their removal into other parts of the world; and that nothing will, in general, restore the skin toi ts original fairness but a long succession of intermixtures with the Europena variety. It is a singular circumstance that the black colour appears to form a less permanent habit than the red or olive; or in other words, the colour chiefly produced by the action of the sun's colorific rays, than that produced by the action of its colorific rays: for the children of oliev and copper-coloured parents exhibit the parental hue from the moment of birth; but in those of blacks it is usually six, eight, or ten months befoer the black pigment is fully secreted. We also sometimes find this not secreted at all, whence the anomaly of white negroes: and sometimes only in interrupted lines or patches, whence the anomaly of spotted negroes: and we have even a few rare cases of negroes in America who, in consequence of very severe illness, have had the whole of the black pigmant absorbed and carried off, and a white pigment diffused in its stead. In other words, we have instances of a black man being suddenly bleached into a white man. These instances are indeed of rare occurrence: but they are sufficient to show the absurdity of the argument for a plurality of human stocks or species, from a mere difference in the colour of the skin; an argument thus proved to be altogether superficial, and which we may gravely assert to be not more than *skin-deep*.

It is in consequence of this power in the system, of secreting a dark-coloured pigment under particular circumstances that we not unfrequently see the skin of very fair women, when in a state of pregnancy, changed to a deep tawny, and almost to a black; and it is hence that the black pigment of the eye is perpetually maintained and replenished.*

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* See Phil. Trans. for 1777, p. 15.

Dr. Wells gave a paper to the Royal Society, which was read April 1, 1813, containing an account of a woman, (Harriet Tresh) "whose left shoulder, arm, and hand, are as black as the blackest African's, while all the rest of the skin is very white. She is a native of Sussex, and the cause she assigns is, that her mother set her foot upon a lobster during her pregnancy." So that we have not only instances of blacks being suddenly bleached, but of whites being made more or less black. In like manner, confined birds, sometimes become wholly black; and are said to become so occasionally in the course of a single night. So the male kestral, from being barred on the tail feathers, becomes wholly ash-coloured except at the end; and the heron, gull, and others, whose tail is white when matured, are for the first two years mottled.

IV. But it is probable that a very great part of the more striking distinctions we have noticed, and almost all the subordinate variations occasionally to be met with, are the result of a MORBID AND HEREDITARY AFFECTION. The vast influence which this recondite but active cause possesses over both the body and the mind, are known in some degree to every one from facts that are daily presenting themselves to us. We see gout, consumption, scrophula, leprosy, propagated on various occasions, and madness, and fatuity, and hypochondriacal affections as frequently. Hence the unhappy race of Albinoes; and whole pedigrees of white negroes; hence the pigmy stature of some families, and the gigantic size of others.

Even when accident, or a cause we cannot discover, has produced a preternatural conformation or defect in a particular organ, it is astonishing to behold how readily it is often copied by the generative principle, and how tenaciously it adheres to the future lineage. A preternatural defect of the hand or foot has been propagated for many generations, and has in numerous instances laid a foundation for the family name. The names of Varus and Plautus among the ancient Romans afford familiar exemplifications. Hence, hornless sheep and hornless oxen produce an equally hornless offspring: the broad-tailed Asiatic sheep yields a progeny with a tail equally monstrous, and often of not less than half a hundred pounds' weight; and dogs and cats with mutilated tails not unfrequently propagate the casual deficiency.

There is a very peculiar variety of the sheep kind given in the Philosophical Transactions for 1813, by Colonel Humphreys of America, and which the American naturalists have called, from its bowed or elbowy legs, ovis *Ancon*: but the common people "the otter breed" from its resemblance to the general form of the otter, and a rumour that it was at first produced by an unnatural intercourse between individuals of the two distinct kinds. Its size is small; the full weight being about 45lb. with loose articulations, crooked fore-legs, and great feebleness of power; whence it walks with difficulty, and is therefore quiet and not fond of rambling. Accident seems to have produced this kind first, but the form has been most correctly preserved in the progeny; and so tenaciously, that if a common sheep and ancon sheep of either sex unite, the young will be either a perfect ancon, or have no trace of it; and if two are lambed at the same time, and one be of one variety and the other of the other, each is found to be perfect in its way, without any amalgamation.

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* Camper's Lect. on Comp. Anat. in regard to the Art of Drawing.

In like manner, in all probability, from some primary accident resulted the peculiar shape of the head and face in most nations as well as in most families; and hence too those enormous prominences on the hinder parts of one or two of the nations at the back of the Cape of Good Hope, of which an instance was not long since exhibited in this country with some degree of outrage on moral feeling.

Man, then, is not the only animal in which such variations of form and feature occur; nor the animal in which they occur either most frequently or in the most extraordinary and extravagant manner.

M. Blumenbach, who has pursued this interesting subject with a liveliness the most entertaining, and a chain of argument the most convincing, has selected the swine genus from among many other quadrupeds that would have answered as well, especially the dog and the sheep, in order to institute a comparison of this very kind; and he has completely succeeded in showing that the swine, even in countries where we have historical and undeniable proofs, as especially in America, of its being derived from one common and imported stock, exhibits, in its different varieties, distinctions not only as numerous and astonishing, but, so far as relates to the exterior frame, of the very same kind as are to be met with in the different varieties of the human species.

In regard to size the Cuba swine, well-known, as he observes, to have been imported into that island from Europe, are at the present day double the height and magnitude of the stock from which they were bred. Whence we may well laugh at every argument in favour of more than one human stock or species drawn from the difference of stature in different nations of man. In regard to colour they display at least as great a diversity. In Piedmont the swine are black; in Bavaria reddish-brown; in Normandy white. Human hair, observes M. Blumenbach, is somewhat different from swine's bristles; yet in the present point of view they may be compared with each other. Fair hair is soft, and of a silky texture; black hair is coarser, and often woolly. In like manner, among the white swine in Normandy, the bristles on the body are longer and softer than among other swine; and even those on the back, which are usually stouter than the rest, are flaccid and cannot be employed by the brush-makers.

The whole difference between the cranium of a Negro and that of an European is in no respect greater than that which exists between the cranium of the wild boar and that of the domestic swine. Those who are in possession of Daubenton's drawings of the two, must be sensible of this the first moment they compare them together. The peculiarity among the Hindus of having the bone of the leg remarkably long, meets a precise parallel in the swine of Normandy, which stands so high on their hind quarters, that the back forms an inclined plane to the head; and as the head itself partakes of the same direction, the snout is but little removed from the ground.

In some countries, indeed, the swine have degenerated into races that in singularity far exceed the most extravagant variations that have been found among the human species. What can differ more widely than a cloven foot and a solid hoof? yet swine are found with both: the variety with a solid hoof was known to the ancients, and still exists in Hungary and Sweden; and even the common sort that were carried by the Spaniards to the isle of Cuba, in 1509, have since degenerated into a variety with a hoof of the same solid kind, and of the enormous size of not less than half a span in diameter.

How absurd, then, to contend that the distinctions in the different varieties of the human race must have proceeded from a plurality of species, while we are compelled to admit that distinctions of a similar kind, but more numerous and more extravagant, have proceeded from a single species in other animals!

It may appear singular, perhaps, that I have taken no notice of the wide difference which is supposed to exist in the intellectual faculties of the different varieties of man. To confess the truth, I have purposely omitted it, because of all the arguments that have ever been offered to support the doctrine of different species, this appears to me the feeblest and most superficial. It may suit the narrow purpose of a slave merchant,—of a trafficker in human nerves and muscles,— of a wretch, who, in equal defiance of the feelings and the laws of the day, has the impudence to offer for sale on the polluted shores of our own country, in one and the same lot, as was the case not long since, a dead cameleopard and a living Hottentot woman :—it may suit their purpose to introduce such a distinction into their creed, and to let it constitute the whole of their creed, but it is a distinction too trifling and evanescent to claim the notice of a physiologist for a moment.

The variable talents of the mind are as propagable as the variable features of the body,—how, or by what means, we know not,—but the fact is incontrovertible. Wit and dulness, genius and idiotism, run in direct streams from generation to generation ; and hence the moral character of families, of tribes, of whole nations. The understanding of the Negro race, it is admitted, is in many tribes strikingly and habitually obtuse. It has thus, indeed, been propagated for a long succession of ages ; and till the Negro mind receives a new turn, till it becomes cultivated and called forth into action by some such benevolent stimulus, as that which is now abroad generally, and especially such as is afforded it by the African Institution of our own country, (an establishment that ought never to be mentioned without reverence,) the same obtuseness must necessarily continue, and by a prolongation of the habit, may, perhaps, even increase. But let the man who would argue from this single fact, that the race of Negroes must be necessarily an inferior species, distinct from all the rest of the world, compare the taste, the talents, the genius, the erudition, that have at different periods blazed forth in different individuals of this despised people, when placed under the fostering providence of kindness and cultivation, with his own or those of the generality of his own countrymen, and let him blush for the mistake he has made, and the injury he has committed.

Freidig, of Vienna, was an excellent architect, and a capital performer on the violin ; Hannibal was not only a colonel of artillery in the Russian service, but deeply skilled in the mathematical and physical sciences ; so, too, was Lislet, of the Isle of France, who was in consequence made a member of the French academy ; and Arno, who was honoured with a diploma of doctor of philosophy, by the University of Wirtemberg, in 1734. Let us add to these the names of Vasa and Ignatius Sancho, whose taste and genius have enriched the polite literature of our own country : and, with such examples of Negro powers before us, is it possible to do otherwise than adopt the very just observation of a very quaint orator, who has told us that the "Negro, like the white man, is still God's image, although carved in ebony?"

Nor is it to a few casual individuals among the black tribes, appearing in distant countries, and at distant æras, that we have to look for the clearest proofs of human intelligence. At this moment, scattered like their own oases, their islands of beautiful verdure, over the eastern and western deserts of Africa, multitudes of little principalities of Negroes are still existing,—multitudes that have, of late years, been detected and are still detecting, whose national virtues would do honour to the most polished states of Europe: while at Timbuctoo, stretching deepest towards the east of these principalities, from the western coast, we meet, if we may credit the accounts we have received, with one of the wealthiest, perhaps one of the most populous and best governed cities in the world; its sovereign a Negro, its army Negroes; its people Negroes; a city, which is the general mart for the commerce of western Africa, and where trade and manufactures seem to be equally esteemed and protected.*

We know not the antiquity of this kingdom: but there can be no doubt of its having a just claim to a very high origin: and it is possible that, at the very period in which our own ancestors, as described by Julius Cæsar, were naked and smeared over with paint, or merely clothed with the skins of wild beasts, living in huts, and worshipping the mistletoe, the black kingdom of Bambarra, of which Timbuctoo is the capital, was as completely established and flourishing as at the present moment.

What has produced the difference we now behold? What has kept the Bambareens, like the Chinese, nearly in a stationary state for, perhaps, upwards of two thousand years, and has enabled the rude and painted Britons to become the first people of the world—the most renowned for arts and for arms—for the best virtues of the heart, and the best faculties of the understanding? Not a difference in the colour of the skin;—but, first, the peculiar favour of the Almighty: next, a political constitution, which was sighed for, and in some degree prefigured by Plato and Tully, but regarded as a masterpiece, beyond the power of human accomplishment: and, lastly, a fond and fostering cultivation of science, in every ramification and department.

Amidst the uproar and ruin of the world around us, these are blessings which we still possess; and which we possess almost exclusively.† Let us prize them as they deserve; let us endeavour to be worthy of them. To the great benefit resulting from literature, and mental cultivation, the age is, indeed, thoroughly awake: and it is consolatory to turn from the sickening scenes of the continent, and fix the eye in this point of view upon our own native spot; to behold the ingenuous minds of multitudes labouring with the desire of useful knowledge; to contemplate the numerous temples that are rising all around us, devoted to taste, to genius, to learning, to the liberal arts; and to mark the generous confederacies by which they are supported and embellished.

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* I follow Mr. Jackson's description, which is added to his "Account of the Empire of Morocco," as by far the most circumstantial and authoritative we have hitherto received. According to him "the city is situated on a plain, surrounded by a sandy eminence, about twelve miles north of the Nile El Abeade, or Nile of the Blacks; and three days' journey (erhellat) from the confines of Sahara; about twelve miles in circumference, but without walls. The town of Kabra, situated on the banks of the river, is its commercial depot or port. The king is the sovereign of Bambarra: the name of this potentate, in 1800, was Woolo: he is a black, and a native of the country he governs. His usual place of residence is Jiunie, though he has three palaces in Timbuctoo, which are said to contain an immense quantity of gold."—The present military appointments are, it seems, entirely from the Negroes of Bambarra: the inhabitants are also, for the most part, Negroes, who possess much of the Arab hospitality, and pride themselves in being attentive to strangers. By means of a water-carriage, east and west of Kabra, great facility is given to the trade of Timbuctoo, which is very extensive, as well in European as in Barbary manufactures. The various costumes, indeed, exhibited in the market-places, and in the streets, sufficiently indicate this, each individual being habited in the dress of his respective country. There is a perfect toleration in matters of religion, except as to Jews. The police is extolled as surpassing any thing of the kind on this side the Desert: robberies and house-breaking are scarcely known. The government of the city is intrusted to a divan of twelve slemma or magistrates; and the civil jurisprudence superintended by a learned Cadi.

† The lecture was delivered in 1812.

In this little school of philosophy, surrounded by walls that were once enriched with the choicest collections, and the rarest curiosities of nature,* but which, from a concurrence of adverse circumstances, must have fallen into ruins, had not you, with laudable patronage, interposed, re-decorated the sinking edifice, and made it once more echo to the voice of instruction and study;—here, where the genius of Science has resumed the possession of his simple throne, and is once more thronged by a numerous train of attentive votaries—here more especially may I address these observations without incurring the charge of rhapsody or extravagance.—Long may so promising an Institution flourish! soundly may it be cultivated! and of sterling value be the harvest that it produces!

LECTURE IV.

ON INSTINCT.

There are various actions, and trains of actions, occasionally to be met with among mankind, but more frequently and more strikingly among other animals, which indicate the employment of definite means to obtain a definite end, without the intervention of that chain of thought which characterizes *reason*, and which have hence been ascribed to a distinct principle, that has been distinguished by the name of *instinct*.

Such, in the new-born infant, and indeed in the young of all mammalian animals, is the act of hunting out for the mother's milky food, and of sucking with a perfection which can never be acquired in subsequent life. Such is the whole process of nestling or nidification among birds; the periodical change of salt for fresh water among the sturgeon, salmon, and other fishes; and, among insects, the formation of the exquisite decoy-lines of the spider, and the nice masonry of the bee, and of the termes *bellicosus* or white ant.

The common fact admits of no dispute; the modes of accounting for it have been various, and in the utmost degree unsatisfactory. In a general survey they may be resolved into three classes: first, those hypotheses which ascribe the whole to the operation of body alone; secondly, those which ascribe it to mind alone; and, thirdly, those which derive it from a substance of a mediate nature between the two, or attribute it partly to the one and partly to the other.

In pursuing this highly interesting subject, I shall first briefly notice the principal opinions which have been offered upon it, in the order thus laid down, and point out their irrelevancy: and then propose a new theory, and explain the grounds upon which it is founded.

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* Formerly celebrated as the Leverian Museum, and erected for that purpose.

I. It was the opinion of Des Cartes that brutes are mere mechanical machines: that they have neither ideas nor sensation: neither pain nor pleasure; and that their outcries under punishment, and their alacrity in pursuing an enemy or devouring a meal are produced by the very same sort of force, which, exerted upon the different keys of an organ compels its respective pipes to give forth different sounds. And a great part of the cardinal Polignac's very elegant Latin poem, entitled Anti-Lucretius, is written in direct support of this most whimsical hypothesis. I shall, perhaps, have occasion to examine it somewhat more at large in a subsequent study: for the present it may be sufficient to observe that, in spite of all the philosophy in the world, the coachman to this hour has whipped, and will yet continue to whip his horses, the huntsman to halloo his hounds, and the bird-trainer to sing or whistle to his bull-finches: though if the whole were mere mechanical machines, they might as well whip the sands, halloo to the waves, and whistle to the winds.

Under this view of the subject all instinctive actions were of course referred to a principle of body, or gross tangible matter, not endowed with peculiar or exclusive properties; and wherever any thing of the same description was to be found among mankind, it was instantly separated from all connexion with intelligence, and referred to the same source.

The incongruities accompanying this hypothesis have not, however, prevented other philosophers from following it to a certain latitude in modern times, although it has been seldom, perhaps never of late days, pursued to the extent contended for by Des Cartes. The ideas of Dr. Reid, who has expressly written upon this subject, do not appear to be very perspicuous: yet he obviously espouses the doctrine of a mechanical principle of animal actions; and the actions which are resolvable into this principle are, in his opinion, of two kinds, those of instinct, and those of habit. Instinct is with him, therefore, as well as with Des Cartes, a property of body or gross matter alone, unendowed with any peculiar powers, and merely operated upon by a combination, of mechanical forces.

II. In direct opposition to this corporeal hypothesis, Mr. Smellie and Dr. Darwin have contended that instinct is altogether a mental principle, the brute tribes possessing an intelligent faculty of the very same nature as mankind, though more limited in its range. From this point, however, these two physiologists disagree, and fly off in opposite directions: the former contending that reason is the result of instinct,* and the latter that instinct is the result of reason. In the promptitude and perfection with which the new-born infant seeks out and sucks its mother's breast, Dr. Darwin asserts that, although the chain of thought which directs it to the accomplishment of its object, is concealed from the view, it still exists; and he endeavours to follow it up and develope it;* in which, however, it is not worth while to accompany him, for the whole process, even upon his own showing, is so complex, that it would rather require the genius of an adult Newton to unfold it, than yield to the dawning powers of a new-born infant.

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* Mr. Smellie defines instinct to be "every original quality of mind *which produces feelings or actions*, when the proper objects are presented to it:"—Philos. of Nat. Hist. vol. i. p. 155. So, p. 159, "From the above facts and reasonings, it seems to be apparent that instincts are original qualities of mind; that every animal is possessed of some of these qualities; that the intelligence and resources of animals are proportioned to the number of instincts with which their minds are endowed; that all animals are, in some measure, *rational beings;* and that the dignity and superiority of the human intellect are necessary results, not of the conformation of our bodies, but of the great variety of instincts which nature has been pleased to confer on the species."

In p. 156, he in like manner confounds mind with sensation, as he has above confounded instinct with mind. "Sensation," says he, "implies a sentient principle or mind. Whatever feels, therefore, is mind. Of course, the lowest species of animals are endowed with mind." It ought to have been first proved that the lowest species of animals are even endowed with sensation.

I will just observe, that in various cases of the instinctive faculty the most excursive theorist cannot picture to his imagination any thing like a chain of thought, or previous reasoning; any thing like a habit or imitation, by which the means and the end are joined together. Let us take, as an example, the very common instance of a brood of young ducks brought up under a hen, and contrary to all the instincts and feelings of the foster-mother, plunging suddenly into the water, while she herself trembles piteously on the brink of the pond, not daring to pursue them, and expecting every moment to see them drowned. By what kind of experience or observation, by what train of thought or reasoning has the scarcely fledged brood been able to discern that a web-foot fits them for swimming, and that a fissured foot would render them incapable?—a knowledge that mankind have only acquired by long and repeated contemplation, and which has never been fully explained to this hour. Habit, imitation, and instruction, would all concur in teaching them to flee from the water, as a source of inevitable destruction: and yet in opposition to all these influences and premonitions, we see them rush into it, and harmlessly: we see them obeying an irresistible impulse, which directs them to what is fitting, stamped in the interior of their little frames, and which is equally remote from the laws of mind and of mechanism.

In like manner, by what process of imitation, education, or reasoning, does the nut-weevil (curculio *nucum*) seek out exclusively, and with the nicest knowledge of the plant, the green hazel in the month of August, while its nut-shell is yet soft and easily penetrable? What past experience or course of argument instructs her that this is the fruit best adapted or perhaps only adapted, to the digestive powers of her future progeny? With a finished knowledge of her art, as soon as she is prepared to deposite her eggs, she singles out a nut, pierces it with her proboscis, and then, turning round accurately, drops an egg into the minute perforation; having accomplished which, she passes on, pierces another nut, drops another egg, and so continues till she has exhausted her entire stock. The nut, not essentially injured, continues to grow. The egg is soon hatched; the young larve or maggot finds its food already ripened and in waiting for it; and about the time of its full growth, falls with the mature nut to the ground, and at length creeps out by gnawing a circular hole in the side. It then burrows under the surface of the ground where it continues dormant for eight months, at the termination of which time it casts its skin, commences a chrysalis of the general shape and appearance of the beetle kind, and in the beginning of August throws off the chrysalid investment, creeps to the surface of the ground, finds itself accommodated with wings, becomes an inhabitant of the air, and instantly pursues the very same train of actions to provide for a new progeny which had been pursued by the parent insect of the year before.

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* "By a due attention to these circumstances, many of the actions, which at first sight seemed only referable to an *inexplicable instinct*, will appear to have been acquired, like *all other animal actions that are attended with consciousness, by the repeated efforts of our muscles under the conduct of our sensations or desires*:"—Zoonom. Lect. xvi. 2. 4. "If it should be asked, what induces a bird to sit weeks on its first eggs, unconscious that a brood of young ones will be the product? the answer must be, that it is the same passion that induces the human mother to hold her offspring whole nights and days in her fond arms, and press it to her bosom, unconscious of its future growth to sense and manhood, till observation or tradition have informed her."—Darwin, Sect. xvi. 13. 4.

In all such cases it is clear that there is a principle implanted in the living form equally distinct from all mechanical, chemical, and rational powers, which directs the agent by an unerring impulse, or in other words, impels it by a prescribed and unerring law, to accomplish a definite end by a definite mean.

Such instinctive powers are not only allowed upon Mr. Smellie's hypothesis, but are conceived to be almost innumerable; and reason, instead of giving birth to them, is in his opinion, as I have already observed, the general result of them, and consists in the power of comparing one instinct with another, and assenting to those that preponderate. According to this hypothesis, all the actions of the involuntary organs of the body are so many instincts, as pulsation, digestion, secretion; all natural feelings are so many instincts, as love of life, dread of death, and the desire of progeny; all the passions are so many instincts, as fear, hope, envy, benevolence, reverence, superstition, devotion; and hence life is nothing more than a bundle of instincts;* and reason, which is itself founded upon an instinctive principle, consists, as I have just observed, of nothing more than a power or tendency to compare the different strengths of these antagonist forces whenever they are brought into a state of action, and to be guided by those that are prepollent: or that offer what is felt or conceived to be the best means of obtaining a proposed end. The objections to which this hypothesis is exposed, or rather the evils chargeable upon it, are innumerable; but it is sufficient to observe, at present, that it as effectually confounds the separate faculties of instinct and reason as the preceding hypothesis of Dr. Darwin, and consequently that neither of the two opinions are in any respect more admissible than those which refer the instinctive faculty to a mechanical principle, or, in other words, to the common properties of unorganized matter.

III. There is a third class of philosophers who, sensible of the difficulty of the case, have endeavoured to get over it by contending that instincts are of a mixed kind; that they either originate in a power which holds an intermediate nature between matter and mind; or else are in some instances simply material, and in others simply mental.

The very excellent and learned Cudworth belonged to the first of these two divisions, and may be regarded as having taken the lead in the scheme which it developes. I have already observed, in a former study, that this profound metaphysician was so strongly attached to the Platonic theory of the creation of the world, that he strove, with the full force of his mighty mind, to restore this theory to general vogue. And as it was one important principle in this theory that incorporeal form, or an active and plastic nature, exists throughout the world independently of pure mind and pure matter, and that the last is solely rendered visible and endowed with manifest properties by an union with this active intermede, Cudworth conceived that all instinctive powers might be satisfactorily resolved into the operation of the same secondary energy in proportion as it pervades the universe.† In opposition to which doctrine, however, it is sufficient to remark that, as the existence of all visible matter, whether organized or unorganized, upon the leading principle of the Platonic theory, is equally the result of this plastic power, and produced by an union with it, it should follow that unorganized matter ought occasionally at least to give proofs of an instinctive faculty, as well as matter in an organized state; proofs of definite means to accomplish a definite end, and that end the general weal, preservation, or reproduction of the body exhibiting it. But as, by the common consent of all mankind, no such faculty is ever to be traced in unorganized matter, it cannot be referred to a principle which is equally common and essential to all visible matter, whether under an organized or an unorganized modification.

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* Transact. of the Royal Society of Edinb. vol. v. p. 39.
† Intellect, Syst. 1743.

At the head of the second division of the last class of philosophers to whom I have referred, we may perhaps place M. Buffon; who, incapable of acceding altogether to the mechanical hypothesis of Des Cartes, yet not choosing to allot to animals below the rank of man the possession of an intelligent principle, kindly endowed them with the property of life, which Des Cartes had morosely withheld, by contending that they were mechanical machines alone, and very obligingly allowed them to possess a faculty of distinguishing between pleasure and pain, together with a general desire for the former and a general aversion for the latter. And having thus equipped the different tribes of brutes, he conceived that he had sufficiently accounted for the existence of instinctive actions, by leaving them to the operation of this distinguishing faculty upon the mechanical properties of their respective organs. M. Reimar, however, an ingenious German professor, who flourished towards the close of the last century, did not conceive in the same manner: and hence, in a work immediately directed to the instinct of animals, and published at Hamburg in 1769, he divides the actions which he apprehends ought to pass under this name into three classes, mechanical, representative, and spontaneous: by the first intending all the proper actions of animal organs over which the will has no control, as the pulsation of the heart, the secretion of the various fluids, and the dilatation of the pupil: by the second, those which depend upon an imperfect kind of memory, and which so far as it is memory, brutes enjoy in common with mankind; and by the third, those which originate from M. Buffon's admitted faculty of distinguishing pleasure from pain, and the desire consequent upon it of possessing the one and avoiding the other.

It is, however, a sufficient answer to both these opinions, which in truth are founded upon one common basis, that, like the theories of Darwin and Smellie, they equally confound, though in a different manner, powers that are essentially distinct. The founders of these opinions may, with Darwin and Smellie, derive the instinctive faculty from a principle of mind, or with Des Cartes and Dr. Reid from a principle of body: but they have no right to derive it from both, or to contend that its different ramifications originate in some instances from the one source, and in others from the other: though, as I have already observed, if they do derive it from mind alone, they will be compelled to admit its existence in a thousand cases in which not a single attribute of mind can be traced; while, if they derive it from body alone, they offer a cause that is inadequate to the effect produced.

M. Cuvier has taken a ground still different from any of these philosophers. He has not, indeed, expressly written upon the subject, but in a very accurate description of a somewhat singular orang-otang,* he sufficiently unfolds his opinion, that instinct consists of ideas which do not originate from sensation, but flow immediately from the brain, and are truly innate. His words are as follows: " the understanding may have ideas without the aid of the senses; two-thirds of the brute creation are moved by ideas which they do not owe to their sensations, but which flow immediately from their brain. Instinct constitutes this order of phenomena: it is composed of ideas truly innate, in which the senses have never had the smallest share." There is a perplexity in this passage, which I am surprised at in the writings of so exact a physiologist: it first confounds instincts with ideas, as other philosophers have confounded them with feelings; and next affirms that ideas may flow from the brain without the aid of the external senses. That the " *understanding* may have ideas without the aid of the senses," I admit; but then it cannot have them from the brain, this being the very foundation and fountain of the senses; that from which they rise, and that in which they terminate. The understanding may, undoubtedly, have ideas from the exercise of its own proper powers alone, but this can only be the case with pure intellectual beings, and to assimilate the faculty of instinct with a faculty of this exalted character, is to clothe brutes with endowments superior to those of mankind; it is to elevate the orang-otang above an Aristotle or a Bacon.

Hence M. Dupont de Nemours, in an article read before the National institute in 1807, advises to drop the term instinct altogether, as the only means of avoiding the rocks on some of which every writer has shipwrecked himself. He asserts, that there is in fact no such thing in existence: and that every action which has hitherto been described under such name, is the mere result of intelligence, of thought, habit, example, or the association of ideas. But this is only to revive, in a new form, the theory of Darwin or of Smellie; while it is only necessary to advert to the explanatory examples offered by M. Dupont himself, to see that many of them are utterly incapable, by any ingenuity whatever, of being resolved into a principle either of intelligence or of mechanism.†

Nothing, therefore, is clearer than that the principle of instinct has hitherto never been explicitly pointed out, nor even the term itself precisely defined; it has been derived from mechanical powers, from mental powers, from both together, and from an imaginary intermediate essence, supposed equally to pervade all embodied matter, and to give it form and structure. It has been made sometimes to include the sensations, sometimes the passions, sometimes the reason, and sometimes the ideas: it has sometimes been restricted to animals, and sometimes extended to vegetable life.‡

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* Annales du Museum et d' Hist. Nat. tom. xvi. p. 46.

† Magazine Encyclopedique, Feb. 1807, p. 437.

‡ Dr. Hancock has lately published a very elaborate volume upon this subject, in which he takes a just view of the instinctive powers of animals, and is half-disposed to allow the same faculty to plants. But in merely distinguishing this faculty from reason, in the same way in which he distinguishes what have hitherto been called innate principles, a moral sense or faculty, light of nature, divine reason, as contra-distinguished from human reason, spiritual power, internal teaching, and even impulse and inspiration of the Holy Spirit, all which he contemplates as *intelligences of a like kind*, or to adopt his own words, "which we can only regard as an EMANATION of divine wisdom," he has so completely generalized the subject, not to say apparently blended into a common principle powers which have usually been regarded as specifically discrepant from each other,—even allowing the existence of the whole of them, and that they all flow, as in such case they must necessarily do, from the same almighty source of being,—that the peculiar nature of the instinctive faculty is left in as much obscurity as ever.

Under these circumstances I shall beg your candid attention to a new view of the subject, and a view that may tend to give us a more definite idea of the nature of the action, and consequently of the extent and real meaning of the term.

In an early lecture of the preceding series[*] I have endeavoured to point out the common or essential, and many of the peculiar properties of inorganic matter; and in a subsequent study[†] I attempted to lay down the more prominent characters by which inorganic is distinguished from organic matter, as a stone, for example, from a plant or an animal. I observed that, on investigating the history of the stone, it would be found to have been produced fortuitously; to have grown by external accretion, and only to be destructible by chemical or mechanical means: while, on investigating the history of the plant or the animal, it would be found to have been produced by generation; to have grown by nutrition, or internal instead of external accretion; and to be destructible by death; to be actuated by an internal power, and possessed of parts mutually dependent, and contributing to each other's functions. I observed farther, that in what this internal power consists we know not: that in plants and animals it appears to be somewhat differently modified, but that wherever we meet with it we term it the PRINCIPLE OF LIFE, and characterize the individual substance it actuates by the name of an organized being, from its possession of organized parts, in contradistinction to all those substances which are destitute as well of life as of internal organs, and which are hence denominated unorganized.

Upon another occasion I took a brief survey of the chief theories which have been offered upon the nature of this mysterious and fugitive essence:[‡] which I observed was altogether a distinct principle from that of thought, and from that of sensation, for both these must also be kept distinguished from each other. I have remarked, that in modern times it had at one period been said to be derived from caloric, thermogene, or the elementary matter of heat, as it exists in the organized system from the well ascertained importance of this substance (if it be a substance) towards the perfection, and even the continuance of all the vital funtions: that at another time it was, for the same reason, supposed to consist of oxygene introduced into the system by every act of inspiration; and still more lately of the Voltaic aura, in consequence of those wonderful effects which this aura is now well known to produce on the muscular fibres of animals, not only during life, but often for some hours after death has taken place. I remarked

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Dr. Hancock has trodden over an extensive ground of both physical and metaphysical research, and the excellent spirit with which he writes, entitles him to the esteem of every good man. Yet I am at a loss to determine why the principle of reason, or the reasoning soul in man, should not have as fair a claim to originate from the divine energy that pervades every part of nature, from the minutest atom to the highest spiritual afflation, as the faculty of instinct. By throwing, however, the principle of human reason out of the general pale, and by associating instinct with the high alliances just adverted to, the "unconscious intelligence," as Dr. Hancock has denominated it, of the lowest part of the animal creation, even that of insects and worms, is raised to a loftier and diviner rank than the peculiar principle by which man has hitherto been supposed to exercise a dominion over the rest of creation. "In the lowest order of animals," says Dr. Hancock, "the divine energy seems to act with most unimpeded power. It is less and less concentrated in the successive links of the living chain upward to man.—The lowest animal has this divine power, not of free choice, nor consciously: the HOLIEST of men has it also, but consciously and willingly; and it then becomes his ruling principle; his divine counsellor; his never-failing help; a light to his feet, and a lantern to his path,"—Essay on Instinct, and its Physical and Moral Relations, p. 170—513.

[*] Ser. I. Lect. IV.

[†] Ser. I. Lect. VIII.

[‡] Ser. I. Lect. X.

farther, that Mr. John Hunter had traced this living principle to many of the organized fluids, as well as to the solids; and that he had especially developed it in the blood, which, coincidently with the Mosaic declaration, he believed to be its immediate seat. "The difficulty," observes he, "of conceiving that the blood is endowed with life while circulating, arises merely from its being a fluid; and the mind not being accustomed to the idea of a living fluid."* And I observed, that by a variety of important and well-defined experiments, this enterprising and indefatigable indagator had succeeded in proving, not only that it contributes in a greater degree to the vital action and to the vital material of the general system than any other constituent part of it, whether solid or fluid, but has all the essential properties of life; that it is capable of being acted upon, and contracting, like the muscular fibre, upon the application of an appropriate stimulus, as atmospheric air, for example; on which occasion it becomes constringed into that cake or coagulum which every one must have beheld in blood drawn from the arm: that in all degrees of atmospherical temperature, of heat or cold, which the body is capable of enduring, it maintains an equality in its own temperature with scarcely any variation: that in the case of paralytic limbs it is the only power that continues vitality in them and preserves them from corruption; that though not vascular itself, it is capable by its own energy of producing new vessels out of its own substance, and vessels too, of every description, lymphatics, arteries, and even nerves; and finally, that though like the muscular fibre, it is capable of contracting upon the application of a certain degree of appropriate stimulus, like the muscular fibre, also, it is instantly exhausted of its vital power whenever such stimulus is excessive; and that the stroke of lightning which destroys the muscular fibre, and leaves it flaccid and incontractile, destroys likewise the blood, and leaves it loose and incoagulable.

In every organized system, then, whether animal or vegetable, and in every part of such system, whether solid or fluid, we trace an evident proof of that controlling and identifying power which physiologists have denominated, and with much propriety, the PRINCIPLE OF LIFE. Of its cause and nature we know no more than we do of the cause and nature of gravitation or magnetism. It is neither essential mind nor essential matter; it is neither passion nor sensation; but though unquestionably distinct from all these, is capable of combining with any of them: it is possessed of its own book of laws, to which, under the same circumstances, it adheres without the smallest deviation: and its sole and uniform aim, whether acting generally or locally, is that of health, preservation, or reproduction. The agency by which it operates is that which we denominate or should denominate INSTINCT, and the actions by which its sole and uniform aim is accomplished are what we mean or should mean by INSTINCTIVE ACTIONS; or to speak somewhat more precisely, instinct is the operation of the living principle, whenever manifestly directing its operations to the health, preservation, or reproduction of a living frame, or any part of such frame.†

The law of instinct, then, is the law of the living principle: instinctive actions are the actions of the living principle; and either is that power which characteristically distinguishes organized from unorganized matter, and pervades and regulates the former as gravitation pervades and regulates the latter, uniformly operating by definite means, in definite circumstances, to the general welfare of the individual system or of its separate organs; advancing them to perfection, preserving them in it, or laying a foundation for their reproduction, as the nature of the case may require. It applies equally to plants and to animals, and to every part of the plant as well as to every part of the animal, so long as such part continues alive.* It is this which maintains from age to age, with so much nicety and precision, the distinctive characters of different kinds and species; which, as is noticed in a preceding study, carries off the waste or worn out matter, supplies it with new,† and in a thousand instances suggests the mode of cure, or even effects the cure itself, in cases of injury or disease. It is "the divinity that stirs within us" of Stahl; the vis medicatrix naturæ of Hoffman and Cullen,‡ and the physicians of our own day. It is hence the strawberry travels from spot to spot, and the cod or the cuckoo, with a wider range, from shore to shore, or from climate to climate.§

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* Essay on the Blood, &c. p. 20.

† This lecture was delivered January 1813; and Mr. Keith, on Tuesday, December 7, 1813, had a valuable paper read before the Linnéan Society, in which, like the present system, he opposes Mr. Knight's hypothesis of gravitation as the cause of the peculiar stimulus and action of plants, and conceives that "the direction of the plumule and radicle of plants must be resolved into *vegetable instinct*, precisely analogous, and equally inexplicable with animal instinct."—See Thomson's Ann. of Philos. vol. iii. p. 71. or No. 13.

In supplying the place of reason, it is perpetually assuming its semblance. Let us take an example or two from both the vegetable and the animal world.

In order that the seeds of plants should produce and perfect their respective kinds, it is necessary that their shoots should rise to the surface of the earth to enjoy the benefit of light and air. Now in whatever direction the eye of a seed, from which germination first radiates, is placed, these shoots ascend equally to the surface, either in curved or straight lines, according as such ascent may be most easily accomplished. Mr. John Hunter sowed a quantity of peas and beans with their eyes placed in different directions, in a tub, which he afterwards inverted, so that the bottom was turned uppermost, while the mould was prevented from falling out by a fine net. And in order that the under surface might possess a superior stimulus of light and heat to the upper, he placed looking glasses around the mouth of the tub in such a way that a much stronger light was reflected upon the inverted mould than that of the direct rays of the sun; while at the same time, he covered the bottom of the tub with straw and mats to prevent the mould, in this direction, from being affected by solar influence. Yet the same instinctive law of ascent still prevailed. After waiting a considerable length of time, and perceiving that no shoots had protruded through the lower surface of the mould, he examined the contents of the tub, and found that they had all equally pressed upwards and were making their way through the long column of mould above them, towards the reversed bottom of the vessel; and that where the eyes had been placed downwards, the young shoots had turned round so as to take the same direction. As one experiment leads on to another, he determined to try the effect of placing other seeds of the same kinds in a tub, to which a rotatory motion should be given, so that every part of it might be equally and alternately uppermost, and the seeds should have no advantage in one direction over another. Here, as we often behold in other cases, the instinctive principle of accommodation was baffled by a superior power, and the different shoots, instead of ever turning round, uniformly adhered to a straight line, except where they met with a pebble or any other resistance, when they made a curve to avoid such obstruction, and then resumed a straight line in the direction into which they were thereby thrown, without ever endeavouring to return to the original path.

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* Mr. Knight, while he seems desirous of resolving the principle of vegetable action into centripetal force, has shown that the sap of plants, as it exists in the leaves of potatoes and mint, and the leaves and shoots of the vine, possess what he calls organizable matter; and when plunged in a moist and warm soil will produce bulbs or roots more or less perfect, or at least preserve and endeavour to extend life.—Phil Trans. 1816, p. 289. The whole, like the reproduction of polypes and worms from sections, ought rather to be resolved into the common law of instinct, the aim of which is health, preservation, or reproduction; and hence the sap of plants seems as much alive as the blood of animals.

† Ser. I. Lect. XIV.

‡ First lines, vol. i. p. 91. 105.

§ In conformity with the general principles of his system, Dr. Darwin ascribes this extraordinary faculty also to the power of reason. "It is probable," says he, "that emigrations were at first undertaken as accident directed, by the more adventurous of their species, and learned from one another like *the discoveries of mankind in navigation.*"—Zoon. sect xvi. 12.

Among animals we have various proofs of a like impulse, and we have also proofs of its being occasionally overpowered by a stronger cause. Thus, in cases of eruptive fever, there is an obvious effort of the instinctive principle to throw the morbific matter towards the surface of the body, where it can do least mischief. And where a deep-seated abscess has formed in the immediate neighbourhood of a cavity that cannot be opened into without great danger, as that of the chest or the stomach, the same instinctive principle of preservation leads forward the action in a different direction, though, as in the experiment of the bean-seeds in the inverted tub, with much greater labour and difficulty; and the abscess at length opens externally; and the remedial process of the formation of new living matter which immediately succeeds, commences under the same mysterious guidance. If, in the course of this common tendency to the surface, an obstructive cause be encountered, of superior force to the instinctive principle itself, the latter, as in the experiment of the beans exposed to the action of a rotatory motion, is overpowered, and the result is doubtful, and often fatal.

But these examples are general: let us advert to a few of a more particular nature. All the different species of birds, in constructing their nests, not only adhere to a peculiar plan, but, wherever they can obtain them, to peculiar kinds of materials; but if these materials be not to be procured, the accommodating power of the instinctive principle, as in the cases just related, directs them to others and suggests the best substitutes. Thus the red-breast uniformly prefers oak leaves as a lining for her nest, wherever she can acquire them; but if these be not to be had, she supplies the want by moss and hair. So where the bird is of small size, and the eggs are naturally numerous, the nest is always made proportionably warm, that the nestlings may all equally partake of the vivifying heat. Thus the wren, who lays from ten to eighteen eggs, constructs her little edifice with the greatest care and of the warmest materials; while the plover and the eagle, whose eggs are so few that the body may easily cover them, build with little solicitude, and sometimes content themselves with the naked cleft of a rock. And thus too, in very cold winters in Lapland, the fond waterfowl will occasionally strip the down off its breast to line its nest and protect its progeny.

When a wasp, in attempting to transport a dead companion from the nest, finds the load too heavy, he cuts of its head, and carries it out in two portions.*

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* Smellie, vol. ii. 151. Reaumur, tom. xi. 241. For an account of other curious instances

A strawberry offset planted in a patch of sand will send forth almost the whole of its runners in the direction in which the proper soil lies nearest, and few, and sometimes none, in the line in which it lies most remote.

"When a tree which requires much moisture (says Mr. Knight,) has sprung up or been planted in a dry soil, in the vicinity of water, it has been observed that much the larger portion of its roots has been directed towards the water; and that when a tree of a different species, and which requires a dry soil, has been placed in a similar situation, it has appeared in the direction given to its roots, to have avoided the water and moist soil."*

"When a tree (remarks Dr. Smith) happens to grow from seed on a wall, (and he particularly alludes to an ash in which the fact actually occurred,) it has been observed, on arriving at a certain size, to stop for a while and send down a root to the ground. As soon as this root was established in the soil, the tree continued increasing to a large magnitude."†

The best means, perhaps, that a plant can possess of resisting the effects of drought, is a tuberous or bulbous root. The grass called phleum *pratense*, or common catstail, when growing in pastures that are uniformly moist, has a fibrous root, for it is locally supplied with a sufficiency of water; but in dry situations, or such as are only occasionally wet, its root acquires a bulbous form, and thus instinctively accommodates the plant with a natural reservoir. And there are various other grasses, as the alopecurus *geniculatus*, or geniculate foxtail, that exhibit the same curious adaptation.‡

There are some philosophers and physiologists who have endeavoured to ascribe the whole of these very extraordinary phænomena to the mechanical powers of gravitation and centrifugal force; among whom I may especially mention Mr. Knight, who has attempted it in the very ingenious paper to which I have just alluded. There are others who ascribe them to the operation of an intelligent principle, among whom, more especially, as I have already observed, is Dr. Darwin. Of these two causes the instances just submitted to you, and thousands more might be added to them, sufficiently prove that the first is inadequate, and that the second does not always exist; at least that the phænomena are often found in organized forms in which, to a certainty, the precise organs do not exist, which are the only known seats of intelligence and sensation in the visible world. They are hence to be resolved into another cause, equally remote from either, more complex in its operations than that of gravity, but less so perhaps than those of intelligence and feeling; embracing a distinct family of well-defined and cognate actions, always aiming at the same common end, the perfection, preservation, or reproduction of the system, in which they exist; and constituting what we should denominate instinct, the general property of the living principle, or the law of organized life in a state of action.

But the subject is too important to be closed here. It remains yet to point out the difference between instinct and sensation or feeling, as well

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of instincts in insects, see Swedish Amœnitates Academicæ, vol. iii. art. 45. Noxa Insectorum, by M. A. Bœchner 1752; and compare with these the younger Huber's Recherches sur les Mœurs des Fourmis Indigenes.

* Phil. Trans. 1811. p. 210.

† Introd. to Botany, p. 114.

‡ See Smith, Introd. to Bot. p. 113. and p. 41.

as between instinct and reason. It remains yet for me to show you that all these are equally distinct principles; that they may exist separately or conjointly; and it remains also for me to offer examples from among the more curious or striking instances of each of these recondite powers, both under a more simple and a more complicated modification. This shall form the basis of our ensuing study. At present I shall only further observe, that instinct may be defined the operation of the principle of organized life by the exercise of certain natural powers directed to the present or future good of the individual; and reason the operation of the principle of intellectual life, by the exercise of certain acquired powers directed to the same end. Both equally answer their object, are equally perfect in their kind, and equally display their common origin.

> Whether with Reason or with Instinct blest,
> Thus all enjoy the power which suits them best;
> And bliss alike by that direction tend,
> And find the means proportion'd to their end.
> Say, where full instinct is th' unerring guide,
> What Pope or Council can they need beside?
> Reason, however able, cool at best,
> Cares not for service, or but serves when prest;
> Stays till we call, and then not often near;
> But honest Instinct comes a volunteer:
> Sure never to o'ershoot, but just to hit,
> While still too wide or short is human wit;
> Sure, by quick nature, happiness to gain,
> Which heavier Reason labours at in vain.
> This too serves always, Reason never long,
> One must go right, the other may go wrong;
> See then the acting and comparing powers,
> One in their nature, which are two in ours;
> And Reason raise o'er Instinct as you can,
> In this 'tis God directs, in that 'tis man. POPE.

LECTURE V.

ON THE DISTINCTIVE CHARACTERS OF INSTINCT, SENSATION, AND INTELLIGENCE.

WE closed our last study by observing that instinct is the operation of the principle of organized life by the exercise of certain natural powers directed to the present or future good of the individual, while reason is the operation of the principle of intellectual life by the exercise of certain acquired powers directed to the same end. Hence reason demands discipline and attains maturity; instinct, on the contrary, neither demands the one nor is capable of attaining the other; it is disciplined and mature from the first, and is as perfect in the infant as in the man.

Instinct, however, has as often been confounded with FEELING or SENSATION as it has with PERCEPTION, which is the outline or foundation of reason: and hence another source of those perplexities and errors in distinguishing between animal and vegetable life which we noticed in the preceding lecture; perplexities and errors which have been productive of the most absurd and disgusting consequences, and especially in regard to the delicate and elegant science of botany.

Instinct, sensation, and perception, are all principles essentially different; they may, indeed, exist conjointly, but each of them is capable of existing separately. Instinct is the common law or property of organized matter, as gravitation is of unorganized: and the former bears the same analogy to sensation and perception as the latter does to crystallization and chemical affinity. Instinct is the general faculty of the organized mass as gravitation is of the unorganized mass ; sensation and perception are peculiar powers or faculties appertaining to the first, as crystallization and affinity are appertaining to the second ; they can only exist under certain circumstances of the organized or unorganized matter to which they respectively belong.

This parallel, indeed, may be carried much farther. Gravitation discovers itself under different modifications, different degrees of power, and consequently different effects. Instinct evinces an equal diversity in all these instances. Gravitation belongs equally to the smallest and to the largest portions of unorganized matter : instinct in like manner belongs equally to the smallest and to the largest portions of organized matter ; it exists alike in solids and in fluids ; in the whole frame, and in every part of the frame ; in every organ, and in every part of every organ, so long as the principle of life continues Sir Isaac Newton established the doctrine of gravitation, and overcame all objections to it chiefly by the modesty with which he propounded and illustrated it. Without inquiring into the nature of its essence, he contented himself with recognising it by its operations and laws. It is the aim of the present study to follow this great example ; and leaving all discussions concerning the essence of instinct or of organized life, on which instinct is dependent, and which constitutes its sphere, as matter constitutes the sphere of gravitation, to point out nothing more than the nature of its action, and occasionally to catch a glance at the laws by which it is regulated.

From what has been already said, we see clearly that the power of instinct runs equally through the limits of vegetable and animal life, and consequently that instinct, sensation, and perception, whatever they consist in, are powers or principles essentially different. Instinct is the common property of organized life in all its forms, but life itself is not necessarily connected either with reason or sensation ; and it is of no small consequence that we attend to this curious and extraordinary fact, the proofs of which are abundantly in our own possession. The blood is alive, and has all the common properties of life, as was very satisfactorily shown in an antecedent lecture, from the experiments of Mr. John Hunter ; but we all know that it possesses neither feeling nor intelligence ; the bones, the cartilages, the cellular membrane, and the cuticle, are alive ; but, in a state of health, they are equally destitute of both these properties, and whether in health or disease, are always destitute of the latter.

Sensation and perception, so far as we are capable of witnessing, can only exist in appropriate organs, as nerves, or modifications of nerves, which are the only known seat of the one, and the brain, or some modification of brain, which is the only known seat of the other. In the higher classes of animals, as mammals, birds, amphibials, and fishes, the nerves take their rise from the brain, or rather from some particular part of it. But this is not an indispensable law of life ; for, in insects, we meet with nerves, but no brain ; and in most zoophytic and many other tribes of worms, with neither brain nor nerves. And hence, wherever these organs or either of them are discoverable, it is consistent with right reason to infer, that the faculty also exists to which they respectively give rise. But on the contrary, where neither of these organs exist, as in plants, and a multitude of the lowest tribes of animals, which in the zoological system of Lamarck, are on this account denominated *apathic* or insentient,* we have the same reason for inferring that, though life is present, and, indeed, in many instances peculiarly tenacious and vigorous, there is neither intelligence nor sensation; and that the whole of the vital functions and operations are performed, like the semblances of intelligence in the preceding case, by the common law of instinct; which, operating in different ways, in different organs, and beings of different structures, appertains to living matter of every kind.

These observations will apply to the vegetable as well as to the animal kingdom; for plants have a close analogy to the senseless tribes, the tubipores, madrepores, sponges, and infusory worms, we are now contemplating in their structure and origin, as well as in the limited range of their powers; these animals being in many instances equally simple in their make, and equally destitute of loco-motion; and equally propagating their kinds by the generation of buds or bulbs, instead of by that of seeds or eggs. Like these low kinds of animals, plants, moreover, are altogether without organs, either of sense or intelligence: and it is consequently correct to infer, that they are equally without the faculties which it is the sole property of such organs to develope. And hence, again, however curious and astonishing the powers they occasionally evince, they are powers that can only be resolved, as in the case of zoophytic worms, into the ever present and ever active law of instinct or organized life. We hear, indeed, at times, of the ascription of mental or corporeal passions to vegetables; of general feeling and ideas; of love and languishment, and desire and aversion. But all this is fancy, and proceeds from an erroneous and contracted view of the general nature of the law of instinct, and its extraordinary power of supplying the place of sense and reason, where these, or the organs in which they reside, are not present. We hear, in like manner, occasionally, of the brain, stomach, lungs, and nerves of vegetables; but all this is still more imaginary than the preceding; it is a mere fancy built upon a mere fancy: nobody has ever been capable of pointing out the probable or even possible seat of such organs, and they have only been idly conjectured because the faculties to which they give rise have been conjectured antecedently.

Is there then no such thing as instinctive feeling?—a term in every one's mouth, and which every one till he tries, supposes he comprehends? What but an instinctive feeling is the love of life, the dread of death, the economy of pairing, and the desire of progeny?

Wherever feeling exists, these, in a certain sense, may unquestionably be called instinctive feelings; but it should be remembered that the expression is, in every instance, of a compound character, and involves two distinct ideas, which may exist either separately or conjointly: and we have the same reason for using the phrase *instinctive intelligence* as *instinctive feeling*: for we can only mean, or ought only to mean, *instinct* combined with *intelligence*, or *instinct* combined with *feeling* according to the nature of the case before us.

Combinations of this kind, indeed, are not unfrequent; and I shall presently proceed to produce examples of them: but it becomes necessary to observe in the present place, that all the operations we are now adverting to, and which are usually characterized as instinctive feelings, as self-preservation, attachment to life, resistance to destruction, reproduction of the whole or of separate parts of the system, and even the economy of pairing, though often united with feeling, and not unfrequently with intelligence as well, occur nevertheless in a multiplicity of instances in which we have either direct proofs of the most cogent reasons for believing, that there is neither feeling nor intelligence whatever, and that every thing is the result of pure, unintelligent, insentient instinct.

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* Philosophie Zoologique.

I have just observed that the blood is alive: it has all the *common* properties of life; irritability, contractility, and a power of maintaining its natural scale of heat, whatever be the temperature of the atmosphere by which it is surrounded: and it is perpetually showing its attachment to life by the due and discretionary exercise of these properties with a view of preserving life. It equally resists every excess of cold or of heat that may be injurious to it, and hence sometimes raises the thermometer and sometimes depresses it: it contracts itself, like the muscular fibre, upon the application of an appropriate stimulus, and conveys the principle of life, and powerfully assists in applying that principle to parts in which the vital action is languid, or has altogether ceased. There is no part of the animal system that evinces in a more eminent degree the faculty of self-preservation, or self-production, of attachment to life, or of resistance to whatever is injurious, than the blood; and yet every one knows that this faculty is pure, unmixt instinct, equally destitute of feeling or intelligence: it is, as I have already defined instinct to be in every instance, a "simple operation of the principle of organized life by the exercise of certain natural powers directed to the present or future good of the individual."*

In the new laid egg we have an equal proof of the same faculty of self-preservation, the same attachment to life, and resistance to destruction. For, like the blood of a healthy adult, the new-laid egg, the few and simple vessels of which are merely in a nascent and liquescent state, and which can scarcely be regarded otherwise than as a fluid, is capable equally of counteracting heat, cold, and putrefaction, and does forcibly counteract them for a considerable period longer than an egg that has been frozen or in any other way deprived of its vital and instinctive principle. It is this vital and instinctive principle that alone matures the egg, and shapes the matter of which it consists into distinct and specific lineaments, and calls forth the power which it does not yet possess, of sensation and perception. In what way these attributes are produced we know not; but we see them issuing from the matter of the egg alone, when aided by the additional and cherishing power of simple heat. And provided it be properly regulated and applied, it is of no importance from what quarter such heat is derived; for we have already had occasion to observe, that the warmth of a sand-bath or of an oven will answer as effectually as that of the mother's sitting over it.

But let us not rest here: let us proceed to examples of the renewal or propagation of life, from parent stocks; to examples of the reproduction of the whole, or of separate parts of the system, in cases in which there is as obvious a destitution of sensation or intelligence; and where, as in the preceding instances, the whole must be the result of pure insentient instinct.

There is not a single organ in the animal frame but what is perpetually reproducing itself, alternately dying and renewing; so that the same man of to-day has not an individual particle belonging to him of that which constituted his corporeal frame ten, fifteen, or twenty years ago. And yet the whole of this important change, this entire reproduction of the material system, though occurring in sentient and even in intelligent organs, occurs at the same time without any kind of feeling or consciousness in the individual, or the organs that constitute the individual.

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* Compare here Girtanner's Memoires sur l'Irritabilite, consideree comme principe de vie dans la Nature organisee.—Journ. de Physique, 1790.

This very curious fact is still more obvious in the generation of new matter of every kind,—muscular, glandular, bony, and even nervous, upon the death of a considerable portion of an organ in consequence of external injury or other violence. The nice and admirable law by which the dead substance is carried off, and its place supplied by the gradual reproduction of fresh matter of the very same nature and properties, I have already explained.* In the separation of the dead from the living parts, there is generally, though not always, some degree of pain, from the increased local action that takes place, and more especially from the tension given to the skin by the secretion of sound and healthy pus, in order to affect its bursting; but in the actual generation of the new material that is to fill up the cavity, and supply the place of what is lost, there is no pain or sensation whatever in a healthy process; while, as I have likewise already observed, the pointing of the abscess, like the pointing of the seeds of peas, or beans, in what direction soever they are sown, will be uniformly towards the surface,† whatever be the obstacles that must be overcome in order to reach it.

The generation of life, then, no more necessarily demands or implies the existence of sensation, than attachment to life, or a self-preserving principle: it may be combined with it, but it may also exist separately or without it. Monro, indeed, has distinctly proved by experiment, that the limb of a frog can live and be nourished, and its wounds healed, without any nerve whatever, and consequently without any source or known possibility of sensation.

Let us apply this reasoning, which I admit is thus far drawn from individual parts of the system alone, to a regeneration or reproduction of the entire system.

The lungs or gills of an animal are precisely analogous to the leaves of a plant. All these, as I have already observed, are perpetually changing by a nicely balanced alternation of decay and reproduction. In animals and ever-green plants this change is so gradual as to elude all notice. In deciduous plants, on the contrary, it is sudden and obvious to every one; yet the same instinctive power that produces the one change, produces also the other; and as in the former case, we have a perfect consciousness that the effect takes place without any sensation or intelligence, no man will be so extravagant as to maintain that there is any sensation or intelligence concerned in the latter. But the very same process that produces the leaves or shoots of plants, produces also their buds; the vegetable vessels are the same; there is no new principle employed, but merely an adaptation of the one common principle of instinct or the law of simple life, to the production of a different effect; for the very same eye may, by too much or too little pruning of the wood, be converted into a shoot or into a bud. The buds of plants, however, are their proper offspring; and, in many cases, as perfectly so, as their seedlings, or those reared from seeds. In other instances we find a progeny equally perfect produced by a separation of bulbs or roots, or by radicals shooting out from creeping joints, as in the strawberry. In all which it would be absurd, even if plants were possessed of a nervous system, which they are not, to contend that a sense of feeling was more exerted than in the reproduction of the separate organs of an animal, to support the common wear and tear of animal life.

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* Series I. Lect. XIV.

† Series II. Lect. IV.

Why then should it ever have been contended that such a kind of sensation is necessary in the formation of seeds, by the conjoint action of what have been denominated a male and female organization? The stimulus of moisture, of light, heat, and air, evolves equally the specific flower; and the ever-present and all-prevailing law of Nature determines the different parts of the flower, or the different flowers themselves, to be of different characters: the farina is secreted from the anther, a part of which is called the male organ; and as it drops upon the open tube of the pistil, which is denominated the female organ, it becomes a new stimulus, and excites to a new action. But neither stimulus nor action are necessarily sensation, nor the sources of sensation. The pistil, or rather the receptacle which lies at the bottom of the pistil, in consequence of this new excitation, evolves or produces a new material, which we call a seed; but during the formation and evolution of this seed from first to last, there is no more necessity for supposing the existence of any thing like sensation, than during the antecedent stimulus of the light and heat, and moisture, upon the parent stem by which the flower itself became evolved; or during the same stimulus upon the joints or bulbs of the plant by which an equally healthy and perfect progeny has, perhaps, been produced from these different organs.

I have already observed, that in the lowest class of animals we meet with instances of reproduction equally varied, and of the very same nature: sometimes by buds or bulbs, as in the case of the polype; sometimes by slips or lateral offsets, as in one or two species of the leech; and sometimes, and perhaps more generally, by seeds or ova. But as, in the tribes I now refer to, we meet with neither nerves or nervous system, and as the reproduction of living matter does not necessarily demand the existence of a nervous system, or of that corporeal feeling to which alone, so far as we are acquainted with nature, a nervous system is capable of giving birth; we have the strongest reason for supposing that the generation of progeny is, in these cases, as unaccompanied with passion or sensation as in the instance of plants.

I have dwelt the longer upon this subject, as being anxious to divest one of the most elegant and interesting branches of natural history of the grossness and indelicacy with which it has been incrusted by the language and opinions of many modern physiologists: and to open it as widely as possible to the study and pursuit of every one.

It must be obvious, I think, that instinct has no more necessary connexion with feeling or sensation than with intelligence; and that even the faculties of attachment to life, resistance to destruction, the economy of pairing, and the process of generation, though often combined with both sensation and intelligence, are not necessarily combined with either of them; that intelligence is not more discrepant from sensation than sensation is from instinct; that either may exist separately, and that all may exist together.

Whence derive the young of every kind a knowledge of the peculiar powers that are to appertain to them hereafter, even before the full formation of the organs in which those powers are to reside? To adopt the beautiful language of the first physiologist of Rome,

Cornua nata prius vitulo quam frontibus exstent,
Illis iratus petit, atque infestus inurguet:
At catulei pantherarum, scymneique leonum,
Unguibus, ac pedibus jam tum morsuque repugnant,
Vix etiam quom sunt dentes unguesque createi.
Alitum proporso genus alis omne videmus
Fidere, et a pennis tremulum petere auxiliarum.*

The young calf whose horns
Ne'er yet have sprouted, with his naked front
Butts when enrag'd: the lion-whelp or pard
With claws and teeth contends, ere teeth or claws
Scarce spring conspicuous: while the pinion'd tribes
Trust to their wings, and, from th' expanded down
Draw, when first fledg'd, a tremulous defence.

In like manner an infant, in danger of falling from its nurse's arms, stretches out its little hands to break the fall, as though acquainted by experience with the use of such an action. We here meet with an instance of pure instinct; but we pursue the same conduct in adult age, and we have then an example of instinct combined with intelligence; and intelligence, instead of opposing the instinctive exertion, encourages and fortifies it. So when caterpillars, observes Mr. Smellie, are shaken from a tree, in whatever direction they descend, they all instantly turn towards the trunk and climb upwards, though till now they have never been on the surface of the ground.

The vegetable kingdom offers us examples of simple instinct equally singular and marvellous. Thus the stalk of the convolvulus twines from the left or east by the south to the west, the face being towards the south: the phaseolus *vulgaris*, or kidney-bean, pursues the same course: while the honey-suckle and the hop take a perfectly reverse direction. Who will reveal to us the cause of these differences?

In the following instances the cause is obvious: it proceeds from the peculiar structure and power of the different animals to which they relate: and it would perhaps be as obvious to us in the preceding, were we as intimately acquainted with the nature of plants as of animals. The squirrel, the field-mouse, and the very curious bird called nut-hatch (sitta *Europœa*,) live equally on hazle-nuts; but each of them opens them in a very different manner. The squirrel, after rasping off the small end, splits the shell in two with his long fore-teeth, as a man does with his knife: the field-mouse nibbles a hole with his teeth as regular as if drilled with a whimble, and yet so small that it is wonderful how the kernal can be extracted through it: while the nut-hatch picks an irregular ragged hole with his bill; but as this artist has no paws to hold the nut firm while he pierces it, like an adroit workman he fixes it, as it were, in a vice in some cleft of a tree or in some crevice; when, standing over it, he readily perforates the stubborn shell; and while at work makes a rapping noise that may be heard at a considerable distance.†

The sphex or ichneumon wasp, in its perfect state, feeds on the nectary of flowers; but as soon as she is fitted to deposite her eggs, she becomes actuated by an appetite of another kind. She first bores a small cylindrical hole in a sandy soil, into which, by accurately turning round, she drops an egg: she then seeks out a small green caterpillar that inhabits the leaves of the cabbage-plant, and which she punctures with her sting, yet so slightly and delicately as not to kill it; she then rolls it up into a circle, and places it in the sandy nest immediately over the egg. She continues the pursuit till she has counted twelve; and has, in like manner, deposited twelve caterpillars one over the other; and repeats the same process till she has exhausted herself of her entire stock of eggs. She immediately closes the holes and dies, intrusting her eggs to the parent heat of the sun. The egg in each separate cell or aperture is soon hatched, and finds its food duly prepared for it, and from its enfeebled state incapable of resisting its attack, though preserved from putrefaction by the little life that has remained to it. It feeds progressively on the twelve caterpillars; and by the time it has exhausted them, becomes fitted for and converted into a chrysalis; in due time it awakes from its dormancy, works its way to the surface of the earth, throws off its chrysalid investment, finds itself accommodated with wings, rises into the atmosphere, feeds on the honey of plants instead of on maggots; and at length pursues the very same train of actions to provide itself with a progeny which was pursued by the parent insect the year before.

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* De Rer. Nat. v. 1038.

† See White's Nat. Hist. of Selborne.

In what I have thus far advanced, I have chiefly proved, however, that instinct may exist separately; I will next proceed to a few examples, in which it will be clear to every one that it may exist in conjunction with each of the other two principles of sensation and intelligence.

And, first, as to its union with sensation. Wherever a nervous system is to be traced, which alone is the source of sensation, we have abundant proofs of such an alliance. We meet with it, without having language by which to describe it, in the glow and elasticity of health, in the satisfaction of a cheerful meal, and in the refreshment of sound and natural sleep after fatigue; and we meet with it still more obviously, and in diversities which language is capable of characterizing, in all those natural emotions to which we have just adverted, and which, in consequence of such alliance, have obtained the popular name of instinctive sensations or feelings, but which in reality are peculiar instincts combined with peculiar feelings.

Let us select a few other examples. We are told by Galen,* that on opening a goat big with young he found one of the young ones alive, which he hastily snatched up, and took it into a room where there were various vessels severally fitted for the purpose with wine, oil, honey, milk, grains, and fruits. The little kid first rose upon its feet and walked; then shook itself, and scratched its side with one of its hoofs: it next smelt alternately at all the dishes before it, and at last fixed upon and licked up the milk. In this case the sense of smell went distinctly in aid of the instinctive search after food, and determined the particular kind: so that the instinct and the sensation co-operated. Thus rabbits, when left to the operation of pure instinct, dig holes in the ground for warmth and protection; but after continuing for some time in a domestic state, and finding that they can obtain a more comfortable asylum by other means, and with less labour, they seldom pursue, even when they have an opportunity, the instinctive process, but burrow in the straw, or whatever material is provided for them.

In this case the sense of superior comfort combines itself, as in the preceding, with the instinct, and pursues the same end, though by a change of the means. So again, the new-born young of all animals, in whatever way they take their food, are at first stimulated by instinct alone.

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* De Locis, lib. vi. cap. 6.

The lamb sucks, the chicken pecks, and the nestling of the sparrow gapes. In like manner, the mother secretes or selects its food from an instinctive stimulus alone. The udder of the dam swells and becomes painful, the crop of the pigeon does the same; and there are some birds, whose common food is grain, that during this season devour for their young, spiders, and other insects, which nothing could induce them to touch at any other time. This sweet intercourse of natural action lays a foundation for something that in a short time shows itself to be superior to instinct, though it has often, but erroneously, been so denominated. The young of two different mothers, if interchanged as soon as they are born or hatched, are as satisfied with the foster or suppositious as with the natural parent; and the mothers, unless made suspicious of the deception, are as satisfied with their foster or suppositious young. But let the same interchange be attempted a week or a month afterwards, and in no case will it succeed. Short as has been the intervening period, there has been a birth of feeling as well as a growth of form; the rising sense has united itself with the already mature instinct; and the natural nurse and the natural nursling will pine equally, if separated from each other.

The poet we have just adverted to, who may pre-eminently be called the poet of nature, has beautifully illustrated this remark by the yearning affection of the cow for her young calf when it has strayed from her, or she has been robbed of it; hunting after it with intense anxiety in every direction, mourning for it with a cry that cannot fail to wind itself into every feeling heart, and equally refusing the fattening glebe and the refreshing stream.* The female Dugong or sea-cow of the Sumatra coast, whose general history we have already given a glance at,† evinces a like degree of maternal affection; insomuch that when its young has been entrapped or speared, the mother pursues it so closely and so fearlessly as to be taken with the greatest ease. The young sea-calves have a short, sharp, pitiable cry, which they frequently repeat; and, like the stricken deer, are also said to shed tears, which, Sir Thomas Raffles tells us, are carefully preserved by the common people as a charm, the possession of which is supposed to secure the affections of those to whom they are attached in the same manner as they attract the mother to her young.‡

The instinct of this early age, however, belongs to such early age alone, and to the purpose of such early age alone: and when it has answered that purpose it ceases, and we meet with no more trace of it: but the feeling which follows so close upon it, and to which perhaps it has given birth, is of a higher order, and continues for a much longer period of time; and for a period of time, indeed, directly proportioned to its intensity, or in other words, to the ascending rank of sentient or percipient life in which it makes its appearance.

Hence in the two lowest classes of animals, we meet with nothing of the sort whatever; the young of insects and worms having a foreign food provided for them without the intervention of the mother: and hence, too, in various quadrupeds and birds the feeling progressively dies away as the young become independent; while in man we behold the principle of intelligence, in its most lovely and interesting character, a moral and internal feeling, a sense of gratitude and veneration on the one side, of keen complacency and delight on the other, and of active affection on both, catching hold of the two preceding principles, and producing a strong cord of interunion that can never be broken but with the cords of the heart itself.

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* De Rer. Nat. ii. 352. † Ser. II. Lect. II. p. 205. ‡ Phil. Trans. 1820. p. 181.

Something of the kind is occasionally, indeed, to be met with in quadrupeds, as I have formerly observed in the case of the seal and lamantin tribes (trichecus *Manatus*,) which pass through life in families of single male and single female, never deserting or deserted by their young, till the latter, having reached the term of maturity, separate to found families of their own.

In these cases we see examples of all the three principles of instinct, sensation, and intelligence in a state of union: and we occasionally meet with still more extraordinary examples of the same fact. One of the most extraordinary, perhaps, is that related by Mr. Gilbert White, in his very interesting History of Selbourn, of the gratitude and affection of a young hare towards a cat by which it had been suckled and brought up; the leveret following the cat about the garden, playing with her like a kitten, and bounding towards her upon her purring or uttering any other call of tenderness.

We see something of the same kind of internal feeling, and often exalted to a still higher pitch, in the gratitude and affection of the fond and faithful dog for a kind and indulgent master; occasionally indeed rising superior to, and openly triumphing over the strongest instinctive feelings of the animal frame, over thirst and hunger, and the love of life itself; and inciting him to perish voluntarily by the side of his master and share his grave, rather than abandon his corse, when in the course of a solitary journey he has suddenly fallen a victim to accident or violence. The late Bishop of Landaff has a striking anecdote to this effect in his very interesting Life, in which he relates the sudden disappearance of a man, who, it seems, had perished on the top of Helvellyn; his body was found two months afterwards in this exposed and desolate spot, with his faithful dog still sitting by it.* And he adds in a similar tale, told him by the Duke of Northumberland, concerning a young antelope that had perished by a fall, whose mother immediately quitted the pasture in which she was feeding, sat piteously by the side of the body, which she refused to quit, and died of grief and hunger.

I will only adjoin another case of a like interesting kind that occurred not long since in my own family. A favourite cat, that was accustomed from day to day to take her station quietly at my elbow, on the writing-table, sometimes for hour after hour, while I was engaged in study, became at length less constant in her attendance, as she had a kitten to take care of. One morning she placed herself in the same spot, but seemed unquiet; and, instead of seating herself as usual, continued to rub her furry sides against my hand and pen, as though resolved to draw my attention and make me leave off. As soon as she had accomplished this point she leaped down on the carpet, and made towards the door with a look of great uneasiness. I opened the door for her as she seemed to desire; but instead of going forward, she turned round and looked earnestly at me as though she wished me to follow her, or had something to communicate. I did not fully understand her meaning, and being much engaged at the time, shut the door upon her that she might go where she liked. In less than an hour afterwards she had again found an entrance into the room, and drawn close to me; but instead of mounting the table and rubbing herself against my hand as before, she was now under the table and continued to rub herself against my feet; on moving which, I struck them against a something which seemed to be in their way; and, on looking down, beheld with equal grief and astonishment, the dead body of her little kitten covered over with cinder-dust, and which, I supposed, had been alive and in good health. I now entered into the entire train of this afflicted cat's feelings. She had suddenly lost the nursling she doted on, and was resolved to make me acquainted with it,—assuredly that I might know her grief, and probably also that I might inquire into the cause; and finding me too dull to understand her expressive motioning that I would follow her to the cinder-heap on which the dead kitten had been thrown, she took the great labour of bringing it to me herself, from the area on the basement floor, and up a whole flight of stairs, and laid it at my feet. I took up the kitten in my hand, the cat still following me, made inquiry into the cause of its death, which I found, upon summoning the servants, to have been an accident in which no one was much to blame; and the yearning mother having thus obtained her object, and gotten her master to enter into her cause, and divide her sorrows with her, gradually took comfort, and resumed her former station by my side.

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* Sir Walter Scott has, with much judgment, selected a similar, and perhaps the same, story, as the basis of one of the most impressive and popular ballads in the English language:

I climb'd the dark brow of the mighty Helvellyn,
Lakes and mountains beneath me gleam'd misty and wide,
All was still save, by fits, when the eagle was yelling,
And starting around me the echoes replied, &c. &c.

Yet, not unfrequently we meet with instances of the union of intelligence alone with instinct alone; of design and contrivance directed to extraordinary occasions, no moral or internal feeling being necessary.

The rook usually and instinctively builds her nest in the tallest branches of the tallest trees; in Welbourn church-yard, however, as we learn in a letter from Dr. Darwin, from a relative, a rookery was not long since formed on the outside of the spire, and the tops of the loftiest windows. There had formerly been a row or grove of high trees in the neighbourhood, but they had been cut down; and their aerial tenants being dispossessed of their proper mansion, had betaken themselves to the church-spire and windows, as the most appropriate building for their purpose; and had thus manifestly evinced the alliance of instinct and intelligence.* So the jackdaws of Selbourn, according to Mr. White, not finding a sufficiency of towers and steeples, and lofty houses, on which they usually hung their nests in this pleasant village, accommodated themselves to the occasion, and built them in forsaken rabbit burrows.

The ostrich is accused of a total want of natural feeling, because she abandons her eggs to be hatched by the heat of the sun; when incubation is necessary, however, the ostrich instinctively employs it, and that too in conjunction with an intelligence which is rarely evinced by other birds. Thus, in Senegal, where the heat is still great, she relinquishes her eggs during the day, but sits upon them through the night; and at the Cape of Good Hope, where the heat is less considerable, she sits upon them, like other birds, both day and night. In like manner ducks and geese, though not renowned for sagacity, cover up their eggs when they quit them, till they return to their nest; and there are few birds that do not turn and shift their eggs at different periods of the tedious process of incubation, so as to give an equal degree of warmth to every part. We have already observed, however, that the accommodating power of the instinctive principle to particular circumstances, which so wonderfully enables it to supply the place of reason, gives it, in many instances, a striking assumption of its character. It is, hence, possible that one or two of the examples here noticed may be referable to this accommodating faculty; but the exercise of a certain extent of reason, as a distinct principle, must be admitted in several of them, in which there is not only a display of design and contrivance towards the accomplishment of this new object, but apparently of design and contrivance as the result of a general convention and discussion of the question submitted to the tribe assembled on the occasion, and whose common interest is at stake.

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* Darw. 8vo. i. p. 241.

Generally speaking, the principle of instinct is perfect and infallible in its guidance; there is, however, an occasional aberration, perhaps a playfulness in this as in every other part of nature. Thus the light of the candle is, by flies and various other insects, mistaken for the light and warmth of the sun, often to the loss of limb or even life itself. So the fleshy-fly and blow-fly (musca *carnifica* and m. *vomitoria*) are deceived by the smell of the carrion-flower (stapelia *hirsuta*), and often deposite their eggs upon it instead of upon putrescent meat; in consequence of which the grubs die almost as soon as hatched, for want of proper nourishment.

In like manner, we find occasionally a few migrating birds in countries where they were never seen before, and which have evidently mistaken their course.

There are various instincts, connected for the most part with a singularity of configuration, that are either peculiar to the birds, or altogether anomalous. But they show, at least, that the great Author of nature is the lord and not the slave of his own laws, and is at all times capable of producing definite effects by a diversity of means. Thus the didus *solitarius*, or solitary dodo, in general esteemed almost as stupid a bird as the ostrich, divides the labour of incubation with his female, and alternately sits upon the eggs during her absence. The hen of this tribe has a protuberance on each side of the breast, like the teat of quadrupeds. When the young of the turtle dove are hatched, and capable of receiving nutriment from the crop of the mother, the male parent experiences an equal change and enlargement in this organ, secretes the same nutritive material, and equally contributes to the support of its nestlings.

I have already observed that insects in general deposite their eggs in places admirably suited to the future wants of the nascent larves, and then for ever take leave of their embryo progeny: but the forficula *auricularia*, or common earwig, broods over her young like a hen, and only quits them at night, which is the usual period in which this genus flies in pursuit of food or recreation.

Among migrating birds it is not very uncommon for the males alone to dare the dangers of a distant voyage, and to leave the females behind them; but in the fringilla *Cœlebs*, or chaffinch, we find this rule completely inverted; for the female chaffinches of Sweden quit their males and migrate to Holland towards the winter, and duly return to them in the spring; while many of the males indulge in a profound sleep during the greater period of their absence.

Most vegetables indulge in a winter-sleep of the same kind; but there are some that sleep still longer. Thus the tuberose root of the ferraria *Ferrariola*, an ornamental herbaceous plant of the Cape of Good Hope, remains torpid every alternate year, and sometimes continues in this state for two years together without putting forth either leaf or fibre.

Let us close these observations with a momentary glance at the very singular instinctive powers of the cancer *ruricola*, or land-crab. This is an inhabitant of the tropical regions, and especially of the Bahama islands: it is gregarious, and associates in large bodies that preserve an orderly society, for the most part, in the recesses of inland mountains, though they regularly once a year march down to the sea-side in an army of some millions, to deposite their spawn in the ocean. The time selected for this expedition is usually in the month of May, when they sally forth from the stumps of hollow trees, the clefts of rocks, and subterranean burrows, in enormous multitudes. The whole ground, indeed, is covered with this reptile band of adventurers; and no geometrician could direct them to their destined station by a shorter course. They turn neither to the right hand nor to the left, whatever be the obstacles that intervene; and if they meet with a house they will rather attempt to scale the walls than relinquish the unbroken tenor of their way. Occasionally, however, they are obliged to conform to the face of the country; and if it be intersected by rivers, they pursue the stream to its fountain head. In great dearth of rain they are compelled to halt, when they seek the most convenient encampment, and remain there till the weather changes. They make a similar halt when the sun shines with intense heat, and wait for the cool of the evening. The journey often takes them up three months before they arrive on the sea coast; as soon as they accomplish which, they plunge into the water, shake off their spawn upon the sands, which they leave to nature to mature and vivify, and immediately measure back their steps to the mountains. The spawn, thus abandoned, are not left to perish: the soft sands afford them a proper nidus; the heat of the sun, and the water, give them a birth; when millions of little crabs are seen crawling to the shore, and exploring their way to the interior of the country, and thus quitting their elementary and native habitation, for a new and untried mode of existence. It is the marvellous power of instinct that alone directs them, as it directed the parent hosts from whom they have proceeded; that marvellous power which is co-extensive with the wide range of organic life, universally recognised, though void of sensation; consummately skilful, though destitute of intelligence; demanding no growth or developement of faculties, but mature and perfect from its first formation.

The general corollary resulting from these observations is as follows; that instinct, as I have already defined it to be, is the operation of the principle of organized life by the exercise of certain natural powers directed to the present or future good of the individual; while reason is the operation of the principle of intellectual life by the exercise of certain acquired powers directed to the same object: that it appertains to the whole organized mass, as gravitation does to the whole unorganized; equally actuating the smallest and the largest portions, the minutest particles and the bulkiest systems; every organ and every part of every organ, whether solid or fluid, so long as it continues alive: that, like gravitation, it exhibits, under particular circumstances, different modifications, different powers, and different effects; but that, like gravitation, too, it is subject to its own division of laws, to which, under definite circumstances, it adheres without the smallest deviation; and that its sole and uniform aim, whether acting generally or locally, is that of perfection, preservation, or reproduction.

Of its mode of existence we know nothing: but as little do we know of the principle of gravitation or of mind. We can only assure ourselves that they are distinct powers, perhaps distinct essences; and we see them acting, as well separately as conjointly, for the general good. Under their accordant influence we behold the plastic and mysterious substance of matter, which we must be especially careful not to confound with themselves, rising from "airy nothing" into entity: ascending from invisible elements into worlds and systems of worlds; from shapeless chaos and confusion, into form, and order, and harmony; from brute and lifeless immobility, into energy and activity; into a display of instinct, feeling, perception; of being, and beauty, and happiness. One common design, one uniform code of laws, equally simple and majestic, equally local and comprehensive, pervades, informs, unites, and consummates the whole. The effect then being one, the mighty cause that produced it must be one also; an eternal and infinite unity—the radiating fountain of all possible perfections—ever active, but ever at rest—ever present, though never seen—immaterial, incorporeal, ineffable: but the source of all matter, of all mind, of all existences, and all modes of existence. Whatever we behold is God—all nature is his awful temple—all sciences the porticoes that open to it: and the chief duty of philosophy is to conduct us to his altar; to render all our attainments, which are the bounteous afflations of his spirit, subservient to his glory; and to engrave on the tablet of our hearts this great accordant motto of all natural and all revealed religion, of Athens and of Antioch, of Aratus and of St. Paul, "in him we live, and move, and have our being."

Ἐκ Διος αρχωμεσθα—
παντη δε Διος κεχρημεθα παντες·
Του γαρ και γενος εσμεν.[*]

LECTURE VI.

ON SYMPATHY AND FASCINATION.

We have now summarily contemplated several of the most important phænomena both of organic and inorganic nature: and have traced out something of the laws by which these phænomena are produced and regulated. Among the most extraordinary facts that have occurred to us, may perhaps be enumerated the occasional production of effects by causes which do not appear to be immediately connected with them; the operation of one body upon another remotely situated, and which, so far as we are able to trace them, have no medium of communication. The sun is perpetually acting upon and influencing the earth, the earth the moon, the moon the ocean: the magnet operates upon iron, whatever be the sheet of substance interposed; and if the iron be divided into small filings, so that the different particles may move with facility, communicates to each an obvious polarity, and gives to the whole a peculiar and beautiful arrangement. And the repulsive and attractive powers of the electric fluid are supposed to act upon each other, not only where two or more particles of this fluid are perfectly or very nearly in contact, but between all particles of it, at all distances, whatever obstacles may lie between them.*

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[*] Arat. Phænom. 1, 4, 5.

Chemical science lays open to us a wonderful field of similar affections and affinities. Within the range of its peculiar regions, we behold almost every substance evincing a determinate series both of inclinations and of antipathies, strongly attracted by one kind of material, indifferent towards a second, and powerfully avoiding a third. From these extraordinary endowments proceeds unquestionably the union or separation of different bodies, according to the nature of the endowments that are called into action; but their influence, in perhaps every case, commences before such bodies are in a state of contact, and in many cases while they are at a considerable distance from each other.

From lifeless and inorganic matter these peculiar and mysterious affections ascend to vegetable life, and display to us germs, molecules, and fibrils, uniting not at random with germs, molecules, and fibrils, but each selecting the other, and occasionally attracting them from remote situations, the female male, and the male female rudiments; and this with the nicest discrimination of their various powers of crassitude or tenuity, and consequently of reciprocal adaptation, without which no vital entity would ensue. Perhaps one of the most extraordinary instances of this kind we are acquainted with exists in the valisneria *spiralis*, an aquatic and diœcous plant, or one belonging to that class in which the male and the female are instinct individuals. The male has a long spiral stem by which its flower is enabled at all times to adapt itself to the surface of the water, from the bottom of which the plant shoots forth, and to float in the middle of tide-streams of almost every variation of ascent. The stem of the female is straight, and much shorter; and is hence only found in shallow waters, or on shores, where the tide exerts but little influence. Thus differently formed and remotely situated, how is that union to take place, without which there could be no increment, and the valisneria would be blotted out of the book of vegetable life. The whole process is wonderful; a part of it is obvious, but the rest is concealed. As soon as the male flower is become perfected, the spiral stem dries away, and the flower separates itself from it, and sails gallantly over the water in pursuit of the female, for the most part driven, indeed, by a current of the wind or of the stream; yet as soon as it arrives within a certain range of the female, it obeys a new influence, and is attracted towards it in various instances even in opposition to wind and tide, the powers that have hitherto directed it. What, now, is this stupendous influence that thus operates at a distance, and gives to the male flower a new direction? It may possibly be a peculiar kind of odour or aroma; and perhaps this is the most philosophical way of accounting for the fact; but however philosophical, it is altogether hypothetical, for we are incapable of ascertaining, and know nothing of the existence of any such exhalation; and could we detect it, we should be still totally ignorant of its mode of operation.

The same curious phænomena seem not unfrequently to take place in the animal system: for here also we can truly affirm that bodies appear to act where they are not, and where we can trace no communicating medium. A small laceration on one of the fingers, sometimes in our own country, but far more frequently in warmer climates, will produce, if unattended to, the disease of a locked jaw; and an inflammation or abscess of the liver, a severe pain in the left shoulder. Yet in both these cases we are not distinctly acquainted with any closer connexion subsisting between the finger and the jaw, or the liver and the left shoulder, than there is between these different organs and any other part of the system. We may theorize upon the nature of the communication, but we have no certain knowledge.

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* Young's Lectures, vol. i. p. 659.

The same fact is strikingly exemplified in the different operations of different poisons when introduced into the stomach. Thus it has been observed by Mr. Brodie, in a valuable and ingenious paper, published in the Philosophical Transactions for 1811, that the infusion of tobacco, applied to any part of the alimentary canal, almost instantaneously, and apparently by some other means than that of the circulation of the blood, destroys the action of the heart, and consequently stops the pulsation, while the brain, and the other muscles of the system, besides the heart, are comparatively but little affected: and that alcohol, on the contrary, the essential oil of almonds, and the juice of aconite, destroy as rapidly the action of the brain, and throw the animal into violent convulsions, laborious respiration, and deadly stupor, while the heart continues its usual or nearly its usual pulsation, not only during the whole of the symptoms, but for some minutes after death has actually taken place. The woorara, perhaps a species of ticunas, with which the Indians of Guiana poison the points of their arrows, produces the same effect, when inserted into a wound, as aconite-juice introduced into the stomach: it operates almost entirely upon the organ of the brain, and more rapidly than it could arrive there by the course of the circulation. The upas *Antiar*, the anthiar *Toxicaria* of Leschenaut, on the contrary, one of the most fatal vegetable poisons of the island of Java, produces death when inserted into a wound, not by affecting the brain, but, like the infusion of tobacco in the stomach, by destroying the action of the heart.

In like manner, the poison of the cerastes, or horned snake, though so fatal in a few hours, often in a few minutes when received by a wound, seems to produce little or no effect when tasted and swallowed. "It is clear," says Bruce, "the poison has no activity, till through some sore or wound it is admitted into circulation.* And a German physician (continues he) was bold enough to distil the pus or putrid matter flowing from the ulcer of a person infected by the plague, and taste it afterwards without bad consequences.

Of the immediate cause or nature of this diversity of influence—this discrepancy of action between remote organs, we know no more than we do of the cause or nature of gravitation, of magnetism or electricity. It has been denominated, indeed, *sympathy*, *fellow-feeling*, or *consent of parts*, in the general language of physiological writers; and so long as we employ these terms merely to import a definite kind or peculiarity of impulse, they may have their use and convenience; but they convey no knowledge, and ought not to be allowed, as I am afraid they sometimes are, to supply the place of knowledge. That the muscles of the jawbone sometimes associate in their action with the muscles of the hand or foot; the organ of the left shoulder with that of the liver; and the stomach, under some kinds of stimulus with the brain; under others, with the heart; and under a third sort, as all those that excite nausea, with the skin; while the skin, in return, associates very generally with the action of the kidneys, are ascertained and well-established facts; but why they should be facts, or by what power or medium the association is maintained, we are altogether ignorant.

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* Appendix to Travels, p. 301, 8vo. edit.

When the circulation of the blood was first discovered, it was supposed that all these anomalies might fall within the range of this admirable mechanism, and might be explained by its operation. Not one of them, however, is capable of such an explanation. Nor is even the diffused redness which uniformly takes place around the nucleus of an inflamed part, in any degree more intelligible or more referable to this principle; since, in consequence of the device of a circulating system, the vessels in the immediate vicinity of each other, are as much cut off from all direct communication as those at the remotest distance; and only, so far as we are able to trace by ocular experiment, associate by the common current of the blood. That they do, in fact, associate by other means we know: but it is by means altogether concealed from us: it is by what, as already observed, we call sympathy or fellow-feeling; but what we only call so to express a peculiarity of action, the cause of which we are incapable of penetrating.

There is one curious and highly important discovery in the animal economy, however, that has been made, or rather, completely established, within the last two or three years, which seems to show that such associate action of parts, at a distance from each other, may be the result of a direct intercourse or medium of communication, though the connecting channel is too subtile for pursuit: for it seems now to be ascertained, as it had, indeed, been long suspected, though without the proof of actual experiment, that a variety of substances pass from the stomach into the kidneys, apparently without entering into the circulation of the blood, by an unknown and even a much shorter course. Now, to the eye of the anatomist, there are no organs more distinct from each other; they not only lie far remote in situation, but even in different cavities, and are separated by a strong, stout membrane, called the peritonæum.

To determine whether such a channel actually exists or not, Dr. Wollaston introduced into the stomach three grains and a half of the salt called prussiate of potash; the presence of which, in almost all kinds of colourless fluids, is capable of detection to the utmost nicety, by mixing with them a small portion of solution of iron, the colourless compound being immediately marked with a blue tinge. The above quantity was given to a healthy person, about thirty-four years of age, and was repeated every hour to the third time. The natural secretion from the kidneys being tested every half hour, was found in two hours to be slightly dyed, and at the end of four hours to afford a deep blue. At this period, just one hour after taking the last dose, and when the blood-vessels might be supposed to be fully impregnated with the material, if it passed to the kidneys, through this conveyance, blood was taken from the arm, and allowed to coagulate, so that the serum or limpid part of it might be fully separated. The presence of the prussiate was then endeavoured to be discovered, my means of the solution of iron, but without the least effect, for the serum still remained colourless. And in other experiments of a similar kind, made both by Dr. Wollaston and Dr. Marcet, it was satisfactorily ascertained, that the prussiate of potash, though it found its way readily to the kidneys, did not exhibit any trace of its existence in the fluid of any other organ whatever, any more than in that of the blood; as the saliva, the mucus of the nostrils, or the limpid discharge produced by blisters. Mr. Home has since shown, that rhubarb introduced into the stomach in like manner finds a path to the kidneys, apparently without passing through the circulating system.*

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* The only mode by which the present writer can conjecture the possibility of these

Mr. Home at one time suspected that the organ of the spleen afforded a passage from the stomach to the circulation of the blood in the cases before us, instead of the lacteal vessels, which immediately rise from the alimentary canal. This idea, he has, however, since relinquished as erroneous; but had even such a passage existed, it would not have answered the purpose; for it would only have conducted materials by another path to the blood; and the experiments of Dr. Wollaston have sufficiently proved, that the unknown channel, wherever it lies, has no connexion whatever with any part of the system of blood-vessels, or even with the common system of absorbent vessels: and so far he seems to have disproved a previous theory of Mr. Charles Darwin upon this subject, which held, that the absorbent system might become the channel, by assuming a retrograde action. Such action, however, has never been established, and, independently of the experiments before us, it is rendered highly inconceivable, by the known structure of the absorbent vessels themselves.

The corollary, then, resulting from these observations, is, that in the animal system, as well as in inorganic nature, bodies in various instances act where they are not, and through channels of influence or communication, with which we are altogether unacquainted.

The examples thus far offered, in regard to animals, I readily admit, are taken from different parts of the same individual frame: but as they are drawn from parts remotely situated, and whose intercourse, so far as we are able to trace it, is as much cut off as though they were of different frames, excepting, indeed, by a channel, which does not show itself to be resorted to in the cases before us, I mean the blood; they may serve to lay a ground work for our conceiving the possibility of a similar influence or association of action between different parts of different frames, or, which is the same thing, between living body and living body.

I proceed, then, to offer examples of this latter kind of influence. The subject, I am aware, is not only of a very curious, but of a very delicate nature, and requires to be handled with the greatest dexterity; nor do I know of any philosophical work to which we can turn as a proper beacon to direct us in our pursuit, and to determine where the boundary of sober judgment ceases, and that of imagination begins.

Some of the instances I shall refer to, may, perhaps, be denominated instinctive influences. I have no objection to the term; but the facts will remain as singular, and as little accounted for, as if no such term were in existence.

Among quadrupeds, and, so far as we know of them, among amphibials, fishes, and insects, there exists but little attachment of the male to the female during the time of parturition, or to his own young after the female has brought them forth. The seal-tribes, and especially those of the trichechus *Manatus*, or lamantin, from which we have probably derived all the idle stories of mermen and mermaids, together with a few others, may, perhaps, be offered as an exception; for these, and especially the lamantin, form unions of single male with single female that continue

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substances being conveyed to the kidneys by the course of the blood, and becoming manifest in their ordinary secretion on the application of chemical tests, is, that they may be so minutely decomposed by the action of the blood while passing through it, as to be beyond the influence of any tests whatever; and that they only discover themselves in the renal secretion, in consequence of a peculiar attraction or affinity of the organ for such materials, and their being hereby thrown off in a more concentrated form. But this explanation is, after all, merely conjectural. See Stud. of Med. vol. v. p. 283. 2d edit.

through life, and live in distinct families with their offspring, till the last, acquiring maturity, leave their paternal home, and found similar families for themselves. Such, then, being the general fact with regard to other animals, whence comes it to pass that the males among the bird-tribes should evince, with a few exceptions, an attachment that is so rarely to be met with elsewhere? What is that wonderful power that rivets the greater number of male birds to female birds during the time of nestling and incubation; that impels them to take an equal part in constructing the nest, and stimulates them with feelings unknown at any other season? Whence is it that several of them, as the male raven (corvus *Corax*,) divide the toil and time of sitting, and incubate the eggs by day as the female does by night? or, that others of them, leaving to their respective females the entire process of incubation, soothe them through the whole of this tedious period, often extending to not less than six or eight weeks, with their melodies from a neighbouring bush, and supply them with food with the utmost tenderness and punctuality?

Whence is it, more especially amidst birds that feed their young with a viscid chyle or milk, secreted at that peculiar period in the crop or craw, that the crop of the male becomes enlarged and changed in its action, in the very same manner as that of the female, so as to enable him to divide the tender office of nursing, and to supply the young with an equal quantity of nutriment? In the body of the mother we can, perhaps, trace a series of actions which, if they do not give us a full insight into the cause of such a change, and such an additional function, at least prepare us to contemplate it with less astonishment: it is a change, in a very considerable degree, analogous to what occurs in the female frame of most other kinds and classes when similarly situated; and which is evinced in its highest and most beautiful perfection in our own race. But in the production of a similar change in the crop of the male pigeon, we meet with a fact altogether anomalous and alone: there is no connexion of organ with organ; no perceptible chain of actions that can have given rise to it; the frames of the individuals are distinct. It is a pure sympathy excited in one being by a peculiar change produced in the organization of another, and leading to a similar change in the being that is thus most wonderfully and inexplicably operated upon.

Let us pass from the bird tribes to fishes. There are various animals of this class that on being touched, or even approached without being touched, are enabled to exhaust the irritable or sensorial power, or both together, of the hand or other limb that approaches them, so as to paralyze it, and render it incapable of exertion. Such especially, are those fishes which we denominate the torpedo-ray, and the electric eel or gymnote. Of these the former has been longest known to naturalists: for, in consequence of its being an inhabitant of the Mediterranean sea, it is described both by Greek and Roman writers, who impute its distinctive faculty to magic; and conceive that the animal has a power, not only of concentrating this magical energy at option, but if seized hold of by a fishing-hook, of impelling it through the whole length of the hook, line, and rod, to the arm of the angler, and hence by palsying his arm, of effecting his escape. So Oppian in Greek verses, which I will take leave thus to translate:

> The hook'd torpedo, with instinctive force
> Calls all his MAGIC from its secret source;
> And through the hook, the line, the taper pole,

> Throws, to th' offending arm, his stern control,
> The palsied fisherman, in dumb surprise
> Feels through his frame the chilling vapours rise,
> Drops the vain rod, and seems, in stiffening pain,
> Some frost-fix'd wanderer o'er the icy plain.*

There may, perhaps, be some exaggeration in this description; but there are not wanting naturalists of modern times who contend that the torpedo is able to throw his benumbing influence to this extent, and in this manner. This influence, moreover, is altogether voluntary; and hence the animal will sometimes allow himself to be touched without exerting it. He occasionally loiters on the moist sands of the shore after the tide has retreated, burying himself under the sand by a brisk flapping of his fins, which serves to fling this material over him; and in this state he is said to inflict at times, even through the sand that covers him, a torpor so severe as to throw down the astonished passenger that is inadvertently walking over it.

We now know something of the medium through which this animal operates, and have no difficulty in referring it to an electric or Voltaic aura, and can even trace a kind of Voltaic apparatus in its structure. Yet, before the laws or power of electricity or voltaism were known, and, consequently, before the medium by which they act was followed up, which to this hour however, is only know by its results, (for it has never been detected as an object of sense,) it is not to be wondered at that so mysterious an energy, operating or ceasing to operate at the option of the animal, and occasionally operating at a distance from the individual affected, should be regarded as a species of magic or incantation.

The Voltaic power of the electric eel or gymnote, is, however, more obvious and effective than that of the torpedo: the gymnote making a sudden and concentrated assault by shocks, of less or greater violence, as though from a more highly-charged battery; and the torpedo, by a numbness or torpor, whence, indeed, its name, produced by small but incessant vibrations of Voltaism, seldom, excepting in severe cases, amounting to the aggregation of shocks, and precisely similar to what is felt in a limb upon applying to it a greater multitude of weak strokes, rapidly repeated from a small battery or Leyden phial. Yet even the peculiar properties of the gymnote were received with the greatest skepticism for nearly a century after their first discovery: which, as this fish is almost exclusively a native of the warmer seas and rivers of Africa and America, did not take place till the middle of the seventeenth century. They were first pointed out to the French Academy in 1671, by M. Richer, one of the travelling professors sent out by the Academy to conduct certain mathematical observations in Cayenne; but were not generally credited till the concurrent experiments of M. Condamine, Mr. Ingram, Mr. Gravesend, and other celebrated natural historians, set every doubt at rest, about a century afterwards.

The more formidable power of the electric gymnote enables it, upon the authority of almost every experimentist, to give not only severe shocks, both in the water and out of the water, when in actual contact with another animal, but to convey them, as we have just observed that the torpedo is said to do, though upon doubtful testimony, through long rods or poles. It is highly probable, however, that such poles must first be wetted with water; for both the gymnote and the torpedo are found to be limited to precisely the same conducting and non-conducting mediums as are met with in common electricity.

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* Alieut. i. 412.

In these cases we trace something of the medium by which the irritable or sensorial power is exhausted. There are various other cases, however, in which, to this moment, we are as ignorant, and as little capable of tracing it, as mankind must have been in regard to the animals before us, antecedently to a discovery of the electric aura. And I here particularly allude to the torpid effects produced upon poisonous serpents and scorpions in Africa and America, on their being handled by persons of two different descriptions; the one possessing this torpifying power naturally and hereditarily, and the other, acquiring it by artificial preparation; such as chewing the roots or other parts of certain plants, rubbing them in their hands, or bathing the body in aqueous infusions of them, and thus impregnating the body of the operator with their virtues.

There appears to be no country in the world so much infested with serpents of this kind as the ancient Cyrenaica, or that part of Africa which lies northward of the great desert of Sahara. Among the different tribes that formerly inhabited this region, one of the most celebrated was the Psylli; and as this tribe seems to have been in full possession of this power, either from art or nature, and to have given the strongest and most extraordinary proofs of its having possessed it, all persons capable of exerting a similar effect were denominated Psylli by the Greek and Roman writers. And hence Plutarch tells us, that when Cato pursued his march through the Cyrenaic desert in search of Juba, he took with him a variety of these Psylli to suck out the poison from the wounds of such of his soldiers as should be bitten by the numerous serpents of the country.

It appears most probable that the Psylli were not naturally protected against this venom, but from long and skilful practice, were acquainted with the virtue of those plants which, as I have just hinted, answer both as a preservative against the bite, and as an antidote after the bite has been inflicted: and, being strongly addicted to divination or pretended magic, as all the historians who have given us any account of them, affirm them to have been, affected to derive their power of subduing poison from this preternatural source alone, and inculcated the belief that they could only exercise it, by muttering or chanting some potent verse or spell over the person who was affected. And hence the disarming a serpent of his capacity of poisoning, or disarming the poison itself of its deadly effect after a wound had been received, was denominated charming or incantation. So Silius Italicus,* in allusion to the Psylli, or their neighbours, the Marmarides, lib. iii.

> Ad quorum CANTUS mites jacuere Cerastes.
>
> The horned snake lies harmless at their SONG.

This sort of power derived from art or nature, and probably originating in this quarter of the world, appears to have been known in the remotest ages, and to have been uniformly ascribed to the same influence of certain magical words or verses chanted, or uttered in recitative; and it appears also to have been very generally conjectured, that there exist some kinds or species of poisonous serpents that are capable of shutting their ears against the sounds thus uttered, and that will not hearken to or be charmed by the voice of the enchanter, however skilful the enchantment.

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* See also Virgil, Æn. vii. 753, in which he ascribes the salutiferous power both to the song and touch of the enchanter.

> Vipereo generi et graviter spirantibus hydris
> Spargere qui somnos CANTUQUE MANUQUE solebat,
> Mulcebatque iras, et morsus arte levabat.

The sacred books abound in allusion to this popular tradition;* they are equally to be met with in the writings of the Greek and Roman poets, and even in the Sanscrit moralists, as, for example, in the Hitopadesa of Vishnusarman, probably of a higher antiquity than the psalmist himself, who tells us in his book of aphorisms, that "as a charmer draweth a serpent from his hole, so a good wife taking her husband from his place of torture, enjoyeth happiness with him."†

There are some philosophers and historians, who have ventured to disbelieve that any such extraordinary power has ever been possessed by any people. The very cautious writers of the Ancient Universal History express no small degree of skepticism upon this point:‡ and M. Denon, one of the chief of the literati that accompanied Bonaparte to Egypt, has been bold enough to laugh at the assertion, and to regard every pretension to such a power as a direct imposture. He offers, however, no sufficient ground for his ridicule, and is flatly contradicted by the concurrent testimony of all the best travellers, both to Africa and South America. Mr. Bruce is very full and very explicit upon the subject. He distinctly states, from minute personal observation, that "all the blacks in the kingdom of Sennaar, whether Funge or Nuba, are perfectly armed (*by nature*) against the bite of either scorpion or viper. They take the cerastes (or horned serpent, being the most common, and one of the most fatal of all the viper tribes) in their hands at all times, put them in their bosoms, and throw them to one another, as children do apples or balls;"§ during which sport the serpents are seldom irritated to bite, and when they do bite, no mischief ensues from the wound. The Arabs of the same country, however, he tells us as distinctly, have not this protection naturally; but from their infancy, they acquire an exemption from the mortal consequences attending the bite of these animals, by chewing a particular root, and washing themselves with an infusion of particular plants in water.

The Nuba and Funge, however, or those who are preserved naturally from the bite and venom of the viper and scorpion, are also highly skilful in the knowledge and application of these roots, and other parts of plants, to those who have no natural protection or charm. Mr. Bruce has given a particular account of several of these plants, some of which seem only capable of acting against the power of the serpent, others only against that of the scorpion, and a third sort against both. And in either instance, where they secure against the bite or sting, and thus operate as a preventive or prophylactic, they also secure equally against the poison, when introduced into the system by a wound, and thus operate as an antidote.

In South America the natural charm does not seem to be possessed by any tribe: but the artificial charm obtained by the use of peculiar plants, is known as extensively, and employed as successfully, as in Africa, and is found to possess the same double virtue of an antidote and a preventive. One of the most satisfactory accounts of this singular fact is contained in a memoir, drawn up in 1791, by Don Pedro d'Orbies y Vargus, a native of Santa Fe, which details a long and accurate list of experiments which be instituted to ascertain it. The plant chiefly employed by the American Indians, he tells us, is denominated in that part of the world *vejuco de guaco*, guaco-withy, from their having first observed that the bird of this name, or as Catesby calls it, the serpent-hawk, usually sucks it before it attacks poisonous serpents, and then attacks them without mischief.* Prepared by drinking a small portion of the juice of this plant, and inoculating themselves with it, also, by rubbing it upon three small punctures in the hands, breast, and feet, and thus impregnating the body with its virtues, Don Pedro himself, and all his domestics, were accustomed to venture into the open fields, and fearlessly seize hold of the largest and most venomous serpents. It was scarcely ever that the animal thus charmed or fascinated had power to bite, and when he did so, the wound produced was slight and of no consequence. M. Acrell, in the Amœnitates Academicæ, after mentioning the same plant, tells us that the senega is possessed of a like power.†

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* Ps. lviii. 5.; as also Jer. viii. 17.; Deut. xviii. 11.

† Transl. of Sir William Jones.

‡ Vol. iii. p. 491. Appendix.

§ Travels, Appendix, p. 303.

Of the truth of the fact, therefore, thus confirmed by the most trusty travellers and historians, in different quarters of the world, there can be no doubt; and it adds to the facility of believing it to find that other animals besides men are possessed of a similar power. Thus the condor and the wild boar feed harmlessly on the rattlesnake, which appears to offer no resistance to their attack, and suffer no injury from its venom after they have satisfied their hunger. In both these cases, the charm or power of protection appears to be natural, as in the Nuba and Funge tribes of Africa. In the serpent-hawk or guaco, however, just noticed, which derives its chief food from poisonous snakes, and in the tantalus or ibis of Egypt, the numenius *Ibis* of Cuvier, which equally attacks and devours them, the charm or protection seems to be artificial, and to depend upon the virtue of the plant to which they have recourse for this purpose; for I have already observed that the serpent-hawk uniformly applies to the ophiorrhiza before he commences the battle; while the ibis, though he appears to open the fight without any such preparation, retires from the field, if wounded, to the plant which he knows will serve as an antidote, and immediately renews and continues it till he has vanquished his enemy.

The fact, then, being incontrovertible, we have next to inquire into the secret and invisible cause of so very salutiferous and extraordinary an effect; or rather, into the nature of the medium by which so extraordinary an effect is produced. That there is in all these cases a peculiar emanation issuing from the body of the protected, there is little doubt.

But we have no reason for ascribing it to electricity or voltaism, since the persons thus peculiarly endowed, whether by art or nature, whether temporarily or permanently, exhibit no proofs of an electric power, upon any other animal, or of the same power, whatever it may be, in any other way. It appears, nevertheless, to be a power that operates in a manner somewhat similar to, but in some respects more forcible and more general than that of electricity: I mean by exhausting equally and altogether the muscular and sensorial energy of the serpent or scorpion to which it is applied; for, in regard to the serpent kinds, we are told distinctly, as well in America as in Africa, that they remain totally torpid and inactive beneath its influence; scarcely ever being able to muster up force enough to attempt any resistance, even when eaten up alive, as Bruce assures us he has seen them, from tail to head, like a carrot;* a fact which doubtless could never occur in animals so active and courageous, unless they were secretly deprived of all power of resistance.

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* It appears to be the ophiorrhiza *Mungos* of Linnéus.

† Amœn. Acad. vol. vi. No. 112. Morsura Serpentum, 1762.

We are not left, however, to mere conjecture upon this subject: for Mr. Bruce most positively affirms, that they constantly sicken the moment they are laid hold of, and that they are sometimes so exhausted by this invisible power or fascination, as to perish as effectually, though not so rapidly, as though they had been exhausted by an electric battery or a stroke of lightning: "I constantly observed," says he, "that however lively the viper was before, upon being seized by any of these barbarians, he seemed as if taken with *sickness, and feebleness*, frequently shut his eyes, and never turned his mouth towards the arm of the person that held him."† And in another place, he as expressly asserts, that he has seen the animal die while under the stroke of this invisible influence.

We have here, then, an effect produced, and of the most powerful character, by one animal upon another, without our being in the least degree capable of tracing the medium of operation.

Whether in this case actual contact is absolutely necessary, does not seem to have been ascertained or sufficiently attended to.

In the case of electric fishes, we have already seen it is not absolutely necessary; and in another phænomenon, perhaps of a still more extraordinary nature than any I have yet adverted to, it seems to be still less so, and indeed not at all necessary: I mean the very curious fascinating power of the rattlesnake over various small animals, as birds, squirrels, and leverets, which, incapable of turning off their own eyes from those of the serpent-enchanter, and overpowered with terror and amazement, seem to struggle to get away, and yet progressively approach him, as though urged forward, or attracted by a power superior to that of natural instinct, till at length they enter, apparently without any foreign force, into the serpent's mouth, which has all along been open to receive them, and are instantly devoured.

In the difficulty of accounting for this most extraordinary influence, there are some persons who have ventured, as in the preceding cases, to doubt the truth of the fact, since, in the marvellous, it will always be found far more easy to doubt than to determine, though the belief of it has been very generally gaining ground within the course of the last half century. Pennant seems to allow it with some degree of hesitation, admitting, however, the authority of those who have asserted it. Dr. Mead endeavoured to account for it upon the principle of mere terror; my late learned friend, Professor Barton of Philadelphia, upon that of a courageous daring of parent animals in defence of their young, in consequence of which they often venture too near, and are seized upon; Dr. Barton apprehending that this is a fate which more frequently pursues older than younger animals. Neither of these explanations, however, can be very readily assented to; the first being inadequate to the effect produced, and the second being contrary to the general observations of naturalists who have treated upon the subject: in consequence of which Major A. Gordon, of South Carolina, has since ventured upon another explanation, which is highly ingenious, and may hereafter, perhaps, be fully substantiated. In a paper published by him in the New-York Historical Society, he attributes the fascinating power supposed to be possessed by serpents to a vapour which they secrete, and can throw around them to a certain distance at pleasure. He advances various facts in support of this opinion, and observes, that the vapour produces a sickening and stupefying effect; and alludes to a negro who, from a peculiar acuteness of smell, could discover a rattlesnake at a distance of two hundred feet when in the exercise of this power, from his smell being affected by it; and who, on following such indication, always found some animal drawn within its vortex, and struggling with its influence.*

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* Travels, &c. Appendix, p. 302.

† Travels, &c. App. p. 303.

Should this asserted fact be confirmed by others of a like kind, it will give us an insight into the nature, not only of the present, but of similar fascinations, which we stand much in need of. The greater acuteness of smell in barbarous and uncultivated tribes than in those of civilized nations, we have already had occasion to notice, and have endeavoured to account for.† In some instances it is highly probable that the emanation is alone perceptible by the animals that are overpowered by it; which may be the case in the example of serpent-charmers, and sometimes in the fascination of serpents themselves. In other examples, and especially those of artificial emanations, there is an odour of which every one is sensible, though its captivating power is confined to the particular tribe to which it is directed: and I now allude to the mode of charming trout and other fresh-water fishes, by illining the hand with assafœtida, to which indeed we had occasion to refer in a former lecture.‡ The trout, in its intoxication of delight, (for here the charm is accompanied with a forcible pleasure instead of a forcible pain,) resigns all caution, becomes dead to its natural instinct, and so far from flying from the ensnaring hand when introduced into the water, advances to it irresistibly, as the bird to the jaws of the rattlesnake, and suffers itself to be laid hold of and fall a prey to the decoyer.

There is, hence, nothing in the accounts of these curious powers of fascination that is hostile to our own experience: and though our own senses may not be fine enough to detect the medium of action in every instance, whether natural or artificial, we have some reason for ascribing it generally to an overwhelming emanation, capable of leading captive the ordinary instincts and faculties of the animals upon which it is exercised, and hereby of hurrying them headlong to destruction. Catesby, the best natural historian of North America, while admitting that he had never witnessed an instance of the fascination of the rattlesnake, asserts that he had received one uniform account of it from a variety of persons who had witnessed it; nor is it, indeed, denied by Dr. Mead or Professor Barton, but only attempted to be accounted for upon principles which will not apply, or are not adequate.

In truth, the rattlesnake does not seem to be the only serpent that is possessed of this extraordinary influence. The American writers contend that the larger snakes of various kinds have a similar power. Dr. Barrow, in his travels into the interior of South America, asserts this to be a fact well known to almost every peasant in that quarter of the world; and Vaillant, in his travels into Africa, affirms that, at a place called Swortland, beholding a shrike in the very act of fascination by a large serpent at a distance, the fiery eyes and open mouth of which it was gradually approaching with convulsive tremblings, and the most piteous shrieks of distress, he shot the serpent before the bird had reached it; still, however, the bird did not fly, and on taking it up, it was already dead, being killed either by fear or by the fascinating influence of the serpent, although upon measuring the ground he found the space between them to be not less than three feet and a half.

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* Journ. of Science, &c. No. xii. p. 374.

† Ser. I. Lect. XV.

‡ Ser. I. Lect. XV.

M. Acrell, in a very interesting paper upon this subject in the Swedish Amœnitates Academicæ,* contends that the coluber *Berus*, or common viper, is in some degree endowed with the same fascinating power as the rattlesnake. And there is a case much in point inserted in one of the early volumes of the Philosophical Transactions, which states that a mouse, put by way of experiment, into a cage in which a female viper was confined, appeared at first greatly agitated, and was afterwards seen to draw near to the viper gradually, which continued motionless, but with fixed eyes and distended mouth, and at length entered into its jaws, and was devoured.

There is, in truth, a secret kind of influence, but whether of the same kind or distinct from it, we have no means of ascertaining, which other animals possess on particular occasions, and which is even in some cases possessed by man, and is known to disarm the fury of the most enraged or vicious quadrupeds. This is peculiarly seen at times in the case of watch-dogs, over whom some house-breakers have found out the secret of exercising so seductive and quieting a power, as to keep them in a profound silence while the burglary is committed. M. Lindecrantz, another interesting writer in the Amœnitates Academicæ of Sweden, tells us that the natives of Lapland and Dalarne are in possession of this secret generally, insomuch that they can instantly disarm the most furious dog, and oblige him to fly from them with all his usual signs of fear, such as dropping his tail, and suddenly becoming silent.†

Grooms are sometimes found possessed of a similar power over horses. Mr. Townsend, a clergyman of excellent character, and considerable learning, has a striking anecdote to this effect, in his account of James Sullivan, a native of the county which forms the subject of his pen. The man, an awkward, ignorant rustic of the lowest class, was by profession a horse-breaker, and generally nicknamed *the whisperer*, from its being vulgarly supposed that he obtained his influence over unruly horses by whispering to them. The actual secret of his fascinating power he kept entirely to himself, and it has died with him. His son, who is in the same occupation, knows nothing of it. But it was well known to every one that, however unbroken or vicious a horse, or even a mule, might be when brought to him, in the short space of half an hour he became altogether passive under his influence, and was not only entirely gentle and tractable, but in a very considerable degree continued so, though somewhat more submissive to himself than to others. There was a little mystery in his plan, but unquestionably no deceit. When sent for to tame an unruly horse, he ordered the stable door to be shut upon himself and the animal alone, and not to be opened till a given signal. This singular intercourse usually lasted for about half an hour; no bustle was heard, or violence seemingly had recourse to: but when the door was opened on the proper sign being given, the horse was always seen lying down, and the fascinator by his side, playing with him familiarly as a child with a puppy. "I once," says

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* Vol. vi. No. 112. Morsura Serpentum, 1762.

† Vol. iv. No. 53. Canis Familiaris, 1753.

Mr. Townsend, "saw his skill tried on a horse that could never before be brought to stand for a smith to shoe him. The day after Sullivan's half hour lecture, I went, not without some incredulity, to the smith's shop, with many other curious spectators, when we were eye-witnesses of the complete success of his art. This, too, had been a troop-horse, and it was supposed, not without reason, that after regimental discipline had failed, no other would be found availing. I observed that the animal seemed afraid whenever Sullivan either spoke or looked at him."* In common cases, Mr. Townsend adds, even the mysterious preparation of a private interview was not necessary, the animal becoming tame at once. We have here, therefore, another instance of most extraordinary and instantaneous ascendancy of one animal being over another, without any manifest medium of action, which we are occasionally, but not often, called upon to witness. That it could not have been by force is clear; and though natural firmness and intrepidity may do much, they by no means appear to have been sufficient in the present case, and could, indeed, accomplish but little in the dark. Nor does there seem to be any mode of accounting for such a control so reasonable as that of a natural or artificial emanation from the fascinator, which we have already adverted to; and, if the last, obtained, perhaps, as in many of these instances, by illining or impregnating the person of the operator with the virtues of various plants unknown or little known to the rest of the world.

Thus far we may proceed safely upon the subject before us. But some theorizers have not rested satisfied here, and with much rhapsody of invention, have carried forward the same mysterious agency into the recesses of the intellect, and contended that it is by a similar kind of medium, or, sometimes, by a sort of elective attraction, operating invisibly through the moral world, as the imperceptible powers before us operate in the physical, that mind produces occasionally an instantaneous influence upon mind; whence, say they, we are at times impelled by a certain indescribable sympathy, to feel more pleased with one person of less intellectual and perhaps even less moral worth, than with another person, whose endowments in both respects are confessedly superior: whilst others, pursuing the hallucination still farther, have gravely suggested, that it is possibly by some such medium that an intercourse is occasionally maintained between ourselves and the spirits of our departed friends; between this world and worlds around us. To hunt down such vagaries would indeed be a thriftless employment; and I only mention them to show that philosophy has its dreams and romances as well as history or even poetry; and that the principles of physics are as liable to perversion as those of ethics. Philosophy is a pilgrim, for the most part, of honest heart, clear foresight, and unornamented dress and manners; the genuine bride to whom heaven has betrothed him is Reason, of celestial birth and spotless virginity; and the fair fruit of so holy a union is truth, virtue, sobriety, and order. But should ever the plain pilgrim play the truant, as unfortunately in the present corrupt state of things we have reason to fear has too frequently proved a fact, —should ever Philosophy migrate from his proper hermitage, and in an hour of ebriety connect himself with the harlot Imagination, what can be the result of so unlicensed a dalliance but a spawn of monsters and miscreations; of hideous and unreal existences; of phantoms and will-o'the-whisps, equally abhorred by God and man; treacherously hanging up their dim wild-fire, in the pestilent bosom of mists and exhalations, and from their murky shades alluring the incautious inquirer to bogs, and sloughs, and quagmires of wreck and ruin?

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* Survey of the County of Cork, p. 438.

LECTURE VII.

ON SLEEP, DREAMING, REVERY, AND TRANCE; SLEEP-WALKING, AND SLEEP-TALKING.

We are proceeding to a subject of much difficulty in theory, though of the greatest familiarity in fact; and I freely confess to you, that although I have endeavoured to investigate almost every opinion that has been offered upon it, from the time of Aristotle to our own day, I have never met with any thing in the least degree satisfactory, or capable of unravelling the perplexities in which it lies entangled.

What can possibly be more opposite to each other than the two states of wakefulness and sleep?—the senses in full vigour and activity, alive to every pursuit and braced up to every exertion,—and a suspension of all sense whatever, a looseness and inertness of the voluntary powers, so nearly akin to death, that nothing but a daily experience of the fact itself could justify us in expecting that we could ever recover from it.

And yet, while such is the lifelessness without, the mind, now destitute of the control of the will, is often overwhelmed with a chaos of ideas, rushing upon each other with so much rapidity, that the transactions of ages are crowded into moments, and so confused and disjointed, that the wildest and most incongruous fancies flit before us, and every thing that is possible becomes united with every thing that is impossible.

Such, however, are the ordinary means devised by Infinite Wisdom to revivify the animal frame, when exhausted by the labours of the day; to recruit it for new exertions, and enable it to fill up the measure of its existence.

The order I shall take leave to pursue in discussing this abstruse subject will consist, first, in a brief examination of the more prominent hypotheses on sleep and dreaming that have been offered to us by ancient and modern schools: secondly, in a minute analysis of the feelings and phænomena by which these operations are characterized, agreeably to the series in which they occur; thirdly, in submitting the outline of a new theory to explain the entire process; and lastly, in an application of such theory to a variety of other subjects of a similar and equally extraordinary nature.

Sleep may be either natural or morbid. The former is usually produced by whatever exhausts the principle of life; as great muscular excitement, violent pain, vehement use of the external senses; or great mental excitement, as intense thought, or severe distress. Morbid sleep is commonly occasioned by compression or commotion of the brain, and is hence often the result of congestion, plethora, or local injury to the skull.

Compression and commotion, though less frequent, are more direct and obvious causes: and hence the greater number of physiologists believe compression to take place also, though in a slight degree, in every case of natural sleep; and in reality to constitute the immediate, whilst sensorial exhaustion only constitutes the remote, cause of this phænomenon. They appeal to the lethargic effect of a full stomach in infants, and of drunkenness in adults, which they refer to congestion in the brain, in consequence of a greater influx of blood into this organ: and hence they reason that a similar sort of pressure is produced by some means or other in every case of sleep.

But what are the means of pressure thus referred to? And here a considerable difficulty is felt by every school of physiologists: and two distinct schemes are devised to get rid of it. By the one we are directed to the arterial system, which we are told, becomes peculiarly excited and overcharged in the organ of the brain during wakefulness, from the activity of the internal senses.* By the other we are directed to the absorbent system, which from the same activity is said to become worn out and rendered torpid in the same organ; and, hence, to be incapable of carrying off the fine fluid which is perpetually exhaling from the secernent vessels into the ventricles of the brain.

Nothing, however, can be more unfounded than both these conjectures, and it is difficult to determine which of the two is the most so. But we are in no want of either of them, for we are in no want of the pressure which they are invented to account for. The principle of exhaustion alone will, I trust, be found sufficient to answer every purpose as a general cause of natural sleep; and, were it possible for us to add that of local pressure, the sleep would no longer be natural, but morbid.

Before we proceed further, however, I will just hint that Dr. Cullen supposes the nervous fluid or power to be disposed by nature to an alternating state of torpor and mobility.† He does not admit that it is ever exhausted and restored as a secretion;‡ and hence in sleep it is only suspended: and in consequence of this suspension the exercise of sense and volition is suspended also.§ Narcotics do not, therefore, in his view, exhaust, but only suspend the nervous power or fluid, and thus induce sleep, which consists in such suspension. The apparently stimulant power of narcotics, he derives from the vigilant exertion of the vis medicatrix naturæ,—the instinctive effort of nature, to guard against such suspension of vital power as essentially mischievous, and, when carried to an extreme, fatal: and hence, narcotics are with him directly sedative, but only indirectly stimulant. He supposes both sleep and waking to take place upon each other merely by a law of alternation: an explanation that will satisfy few.

But the chief attention of physiologists, both ancient and modern, has been directed to the subject of dreaming, which has usually but erroneously been regarded as a distinct process from that of sleeping. Let us next, therefore, as briefly as may be, and before we enter into a direct analysis of the phænomena that successively arise, take a glance at a few of the conjectures by which *dreaming* has hitherto been accounted for.

Among the Greek philosophers we meet with two explanations that are worthy of notice; that of Epicurus, because of its ingenuity, and that of Aristotle, because it has descended to the present times.

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* This explanation is partly, though not chiefly adopted by the author of the elaborate article on sleep, in Rees' Cyclopædia; and has since been fully embraced by Mr. Carmichael in his learned Essay on Dreaming. See Transactions of the association of Fellows, and Licentiates of the King's and Queen's College of Physicians in Ireland, vol. ii. p. 48. 8vo. 1819. Dubl. His explanation of dreaming is that of Gall and Spurzheim, which the reader will find adverted to subsequently.

† Materia Medica, ii. 226. ‡ Id. p. 223. § Id. p. 226.

According to the Epicurean hypothesis of sensation, all the organs of external sense are stimulated to their appropriate functions, by the friction of an effluvium or emanation thrown off from the body perceived. This doctrine, which still holds good, and is uniformly employed in modern times to explain the sense of taste and smell, was equally extended by Epicurus to those of sight and hearing: the former being supposed to depend upon an effluvium of exquisitely fine films, images or SPECIES, as they were technically called, perpetually issuing in every direction from every existing substance, somewhat in the manner in which snakes and grasshoppers cast off their skins annually, but almost infinitely finer, and altogether invisible. And as these rush against the eye, they were conceived to convey to it a perfect image of the object from which they are ejected. While sound was supposed to be excited in like manner by particles of a peculiar kind thrown off from the sonorous body, and rousing the ears by their appropriate stimulus.

These effluvia of every kind were conceived to be so exquisitely attenuate that they can pass, as light, heat, or electricity does, through a variety of solid bodies, without being destroyed in their passage. The effluvia or pellicles of vision were supposed not unfrequently to arise from the very bodies of those that have been long buried; and to be capable not only of transpiercing the soil in which they are inhumed, and of stimulating the organs of external sight, but of winding through the substance of the flesh, and of stimulating the soul itself in the interior of the animal frame, especially when in a state of sleep, in which the external sense is closed, or of deep abstraction, in which it is inattentive; and thus of presenting to the soul in its naked state, as it may be called, pictures of objects no longer in existence. And hence these philosophers with great ingenuity, though, as it now appears, with great incorrectness, undertook to solve many of the most difficult problems in nature; accounted for the casual appearance of spectres in the gloom of solitude and retirement, and directly unfolded to the world the "stuff that dreams are made of."

It is needless to point out the errors of this system, for it has long sunk into disuse, never to rise again. And I shall therefore proceed to the rival hypothesis of Aristotle, which, though equally unfounded in fact, has been fortunate enough to descend to modern times, and to have met with very powerful advocates in M. Wolff* and M. Formey.† It was the doctrine of Aristotle, that external sensations not only produce by their stimulus a variety of INTELLECTUAL FORMS or images in the sensory, somewhat similar to the ideas of Plato, and for all practical purposes not very dissimilar to what is meant by ideas in the present day, but that these forms or ideas are themselves capable of producing another set of forms or ideas, though of a more airy and visionary kind:

> As every shadow has itself a shade.

And to this secondary set, these slighter and more attenuate pictures of things, he gave the name of PHANTASMS. In the opinion of this philosopher, dreams consist alone of these phantasms, or mere creatures of the imagination, first excited by some previous motion or sensation in the

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[*] Psychol. Empir. sec. 123.

[†] Mem. de l'Acad. de Berlin, ii. 316.

brain, and afterwards continued in a more or less perfect series, according to the power of the imagination itself. The only difference I am able to trace between this theory, as started by Aristotle, and as restarted by Wolff, is in the greater regularity that the latter assigns to the phænomena of dreaming, than the former does: M. Wolff believing them to be, in their commencement, excited, by a sensation, and in their successions and series of representations to be as much controlled by a peculiar system of laws, as the motions of the heavenly bodies. Formey appears to carry this point a little farther: his language is, if the dream be natural, it must necessarily originate agreeably to the law of sensation, and be continued by the law of imagination; and hence he concludes those dreams to be supernatural, which either do not begin by sensation or are not continued by the law of imagination.

It may be sufficient to remark upon this theory, first, that the phantasms of Aristotle have as little claim to entity as the species of Epicurus; next, that the assumption of a code of laws, or rather of two distinct codes of laws to regulate the fleeting train of our ideas in dreaming, is in itself altogether visionary and gratuitous; and that if the term *chance* or *fortuitousness*, a very useful term and full of meaning in all languages, can with propriety be applied to any thing, there is no subject to which it can be better applied than to that of dreaming; in which the will, the only legislator and controller of our ideas, has withdrawn its authority, and left the brain to a temporary lawlessness and misrule. And lastly, that the distinction which is thus attempted to be drawn between natural and supernatural dreams, is not only altogether fanciful, but could never be of any possible avail, even if well founded; for, in order to distinguish between the two, it would be necessary to be intimately acquainted with those laws of sensation and imagination which are here stated to regulate our natural dreams, and the suspension of which produce dreams of a superior character.

We are touching upon a delicate, and perhaps a dangerous inquiry; but as it has been boldly handled in modern times, and made the foundation of a more daring speculation upon the subject, it must not be flinched from in our present discussion. That total absence of all natural law, which M. Formey supposes occasionally to take place in the act of dreaming, and to distinguish the supernatural from the natural vision, Mr. Andrew Baxter,* and, since his time, Bishop Newton, conceive to take place in every instance of dreaming; and hence, that dreaming is at all times, and on all occasions, a supernatural operation. These excellent men divide dreams into two kinds, good and evil; and conceive two kind of agents, good and evil spirits, employed in their production; and consequently account for the one or the other sort of dreams, in proportion as the one or other kind of agents obtains a predominancy.

Now it must be obvious that this conjecture is just as destitute of all tangible basis as either of the preceding; that it can make no appeal to facts submitted to the senses. But, beyond this, its very foundation-stone consists of a principle that no man can readily grant who maturely weighs its full import; namely, that dreaming is altogether an unnatural operation; that nearly one half of our lives is spent in a direct intercourse with invisible beings; and that during this moiety of its existence, man is no longer a free agent; his whole train of thoughts and ideas being not loose and dismantled, but run away with by foreign compulsion, and the work of a demoniacal possession.

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* An Inquiry into the Nature of the Human Soul, wherein the Immortality of the Soul is evinced from the Principles of Reason and Philosophy, 4to. 1730.

The difficulties into which such an explication throws its adherents, are incalculable. Let us confine ourselves to one more example. There can be no doubt that other animals have their dreams as well as man ; and that they have them as vigorous and as lively. Every one has beheld his favourite dog, while asleep by the fire-side in the winter season, violently stretching out his limbs, howling aloud, and at times starting abruptly, beneath the train of images of which his dream is composed. In what manner will such philosophers account for these various phænomena ? Is dreaming a natural operation, or are good and evil spirits the natural attendants upon dogs and cats, as well as upon mankind ? The one or the other of these conclusions must follow ; and there can be no difficulty in determining which of them will possess the general suffrage.

That dreams, like every other concurrence in nature, may occasionally become the medium of some providential suggestion, or supernatural communication, I am by no means disposed to deny. That they have been so employed in former times is unquestionable ; and that they have been so employed occasionally among all nations in former times, is highly probable ; and the peculiar liveliness with which the trains of our dreaming ideas are usually excited, and from a cause which I shall presently endeavour to explain, seems to point out such a mode of communication as peculiarly eligible. But I am at present attending to the natural phænomena alone, and can by no means enter into a consideration of such foreign interference, which, as it certainly has been, may still therefore be, for all we can prove to the contrary, occasionally introduced into them.

In what may be called our own times, there are many valuable writers who have turned their attention to this curious subject, and who concur in the two following important positions. First, that the faculty, or at least the action of the will is suspended during the influence of sleep : and, secondly, that in consequence of this suspension or discontinuance, the trains of ideas which persevere in rushing over the mind, are produced and catenated by that general habit of association which catenates them whilst we are awake. The power of the will, it is contended, is not necessary to the existence of ideas, which, therefore, may continue whilst such power is in a state of abeyance ; but which, if they continue at all, must take the general order and succession imprinted upon them by the law of association, excepting in cases in which such law is broken in upon by a variety of incidental circumstances, as uneasiness arising from a surcharged stomach, or other bodily sensations.

Such are the two fundamental principles upon which the theories of Hartley, Darwin, and Dugald Stewart are respectively built ; and which, in various ways and with almost equal ingenuity, they seem very satisfactorily to have established. But there is still a very important question, and which, indeed, constitutes the chief difficulty of the subject, and that which none of them have attempted to answer, or at least have satisfied themselves upon while making such attempt. I mean, whence comes it to pass that ideas can at all exist in the brain during sleep, or that all the internal senses are not as much locked up as the external senses, and the faculty of the will ?

In the course of the present lecture it will be my endeavour to account for this most curious phænomenon. But we must first follow up, in the series in which they appear to arise, the train of circumstances which accompany sleep and dreaming. The entire study is highly interesting, but requires close attention, in order to its being fully comprehended. And when we have advanced thus far, we shall obtain a clue, if I mistake not, to those equally abstruse and intimately connected subjects, sleep-walking, revery, and winter-sleep; as well as to various other obscurities that ramify from the same source.

The fibres distributed over the moving organs of animals, I have already had occasion to observe, in a preceding lecture,* are of two sorts: those of the nerves, which are called sensitive fibres, and those more properly belonging to the muscles, which are called irritative fibres; which last, however, are always accompanied by a greater or less number of the former; by which, indeed, they become endowed with the sense of touch, as well as are rendered capable of contributing to the other external senses, and of maintaining a communication with the brain, from which the sensitive fibres issue, or in which they terminate.

Both these kinds of fibres become fatigued, exhausted, and torpid, in proportion to the length and violence of their exertion, and recover their power alone by rest. The weariness and flaccidity of the muscles of the arms or legs after extreme exercise, or exercise to which they have not been accustomed, may be adduced as a sufficient proof of the truth of this position.† In like manner, we neither hear, nor see, nor taste, nor feel, with the same accuracy, after any or all the organs of these various functions have been long upon the full stretch of action, with which we do on their first exertion in the morning. Increase or prolong this action, and their power will be still farther obtunded, till at length, like an over-wearied limb, they become perfectly inert and insensible, and give no account of whatever is passing around us; and it is this general torpitude or inaction of all the external senses, which we call SLEEP. By the exercise of the will, or by any other strong stimulus, this sleep or sensorial torpitude may be postponed; and, *vice versa*, by the consent of the will, it may be accelerated.

This, however, is sleep in its first or simplest shape alone: it is that which I shall take leave to call SLUMBER, and is the mere sleep, or torpitude of the organs of external sense; the will being drowsy, indeed, but still continuing in some degree awake: whence the sleeper, if he lie or sit in any uneasy position, exercises his muscles, which are still under the control of the will, and the position is changed. The other internal senses also, as those of memory, imagination, and consciousness, are in like manner, in a greater or less degree awake; whence the mind is yet filled with ideas, that crowd upon one another with about an equal degree of regularity and confusion: and, if we be spoken to in this state, we return an answer, which intimates indeed that we have heard; but, by its incongruity with the observations made to us, intimates also that the will has, in some degree, lost its control;—that it has become drowsy, and is affected by the slumber of the organs of external sense.

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* Ser. I. Lect. X.

† The principles of the theory here advanced were first given to the world by the author as far back as 1805, in the comment subjoined to his Translation of Lucretius, where the poet is treating of the cause and phænomena of sleep; and may be found in vol. ii. p. 137—141. of that work. Several of the doctrines there laid down have been since advanced in various forms by different writers, though in some cases, very probably, without their having perused his explanation. Thus the immediate cause of sleep, advanced in the present passage, is that chiefly rested upon by the author of the article on sleep in Dr. Rees's Cyclopædia, though he also adverts to an occasional increased action in the vessels of the brain as a concurrent cause. And thus much of the explanation which will here be found to follow, respecting the nature and phænomena of dreaming, have still more lately been offered to the world by Dr. Spurzheim, and adopted from him by Mr. Carmichael of Dublin, with the exception that they have interwoven such views with their peculiar doctrine of a plurality of organs in the brain; which, for reasons that will be given in a subsequent Lecture, (Ser. III. Lect. XIII.) the present author cannot admit; and does not conceive is by any means necessary on the present occasion. Such coincidences of opinion, however, and especially if they should be accidental, and not derived from his comment on Lucretius, give a considerable degree of confirmation to the general basis on which the theory rests. The Lecture, as now published, was delivered in the spring of 1811.

If the general exhaustion be not very considerable, as after dinner, or during the digestion of any other meal, the sleep may not extend beyond this first or simple stage of slumber; though it should be observed that, from the power of association, the internal and external senses have a strong tendency, if in health, to concur or catenate in one common state or action. When the one are in full vigour, the other are usually in full vigour also; and when the one become drowsy, the other incline to the same drowsiness. But if the general exhaustion be more violent than we are now contemplating, the internal sense will unquestionably concur in the effect, and evince, in some or all of them, an equal degree of sleep.

The first of the internal senses that becomes thus influenced is the will itself. It would be easy to show, if we had time, that the will is infinitely more disposed to catenate with the motions of the external senses than any of the other faculties of the mind. It hence gives way first of all, and sleeps along with the exterior organs, while the other faculties of the mind remain awake. We are now arrived at the second stage of sleep; and it is this which we call and which constitutes DREAMING. The will catenates in the sleep of the organs of exterior sense; but all the interior senses, except the will, are still awake. Hence we have ideas of memory, ideas of consciousness, ideas of imagination, ideas of reasoning; but, destitute of a controlling power, they rush forward with a very considerable degree of irregularity, and would do so with the most unshapeable confusion, but that the power of association still retains some degree of influence, and produces some degree of concert in the midst of the wildest and most extravagant vagaries. And hence that infinite variety that takes place in the character of our dreams; and the greater regularity of some, and the greater irregularity of others.

But the general fatigue and exhaustion may be still more violent; and it may also be produced by motions in which the internal senses have principally co-operated; and in such cases, not the will only, but the whole of the internal senses concur in the common torpor or inertness that is produced; and we now advance to a third state, which I shall beg leave to call LETHARGY: dead, senseless sleep, or a stage of sleep without thought or idea of any kind, but still natural and healthy: the vital organs, though none but the vital organs, still continuing their action.

It has been a question often proposed, whether the mind ever does, or ever can, exist without thinking? But it can only have been proposed by persons who have not paid a due attention to a variety of phænomena, which are perpetually occurring, and which must be conclusive as to the fact. The mind of an infant, or rather of a fetus, must anticipate the thoughts or ideas that are afterwards introduced within it. In a complete paroxysm of apoplexy, no man has ever been conscious of a single thought or idea; in sleepy coma or lethargy in fevers, as opposed to restless coma, the same discontinuity of all thought and idea takes place uniformly; and we meet with it perhaps still more incontrovertibly in all cases of suspended animation from drowning, hanging, or catalepsy. I enter not into an explanation of this state of being; I only advert to the fact: though if we had time I do not think it would be impossible to suggest an explanation that might be satisfactory to every one.

Thus far we have left the vital or involuntary organs, those over which the will exercises no control, in a state of wakefulness, though none but the involuntary organs. For these, in the first place, are far less subject to exhaustion than the organs either of external or internal sense; their actions in a state of health being always more equable and uniform: and hence, secondly, from an independence most wisely ordained, and productive of the utmost benefit to the general system, they never catenate with any other actions, except in cases of extremity. Upon an application, however, of very strong stimuli, whether external, as those of severe pain, or labour, or internal, as those of disease or excessive grief, the vital or involuntary organs themselves are fatigued and exhausted; and when the exhaustion is complete, they also, like the organs of external sense, sleep or become torpid: in other words DEATH ensues, the living principle ceases, and the spirit separates from the body. The resemblance, therefore, between DEATH and SLEEP is not less correct upon the principles of physiology, than it is beautiful among the images of poetry. SLEEP is the DEATH or torpitude of the voluntary organs, while the involuntary continue their accustomed actions. DEATH is the SLEEP or torpitude of the whole.

Every organ of the animal frame recovers from its fatigue or torpor by rest, provided the principle of life continues. Hence the organs of external sense, in a definite period of time, and a period generally proportioned to the degree of their exhaustion, re-acquire their accustomed vigour, are *alive* to the influence of their appropriate stimuli; and the smallest excitement applied to any one of them, throws the whole once more into action, in consequence of their habit of acting associately and by common consent. In other words, the man awakes from SLEEP; he rouses himself from the temporary DEATH of the organs of external sense. Were it possible for the principle of life to continue during a total rest or torpitude of the vital or involuntary organs, as it does during that of the voluntary, there can be no doubt that these also would, in time, recover from their exhaustion; and that the man would, in like manner, awake from the total torpitude, the sleep or death of the entire frame; but this in man, excepting under very particular circumstances, and circumstances I shall advert to presently, is impossible. The rule of nature is, that as soon as the vital or involuntary functions are discontinued, the principle of life ceases; the soul deserts the body; the laws of chemistry, hitherto held in subjection by a superior control, assert their authority; and the whole visible system falls a prey to corruption and ruin.

When the organs of external sense have recruited themselves by repose, I have already observed that the stimulus that rouses the one, rouses at the same time the rest, from a habit of association. From the same habit, the torpitude produced by exhaustion in any single organ is propagated through every other, and the sleep becomes common to the whole; although it is also unquestionable that the whole are fatigued, or partially exhausted, in consequence of the general stock of sensorial power having been borrowed, in a considerable degree, from the rest, and expanded at a single outlet.

The sensitive fibres of the organs of external sense are equally affected, and of course become equally exhausted, whether a stimulus be applied at the one end or at the other, the end terminating externally on that connected with the brain: and hence, internal excitements, as those of severe study, intense grief, undue eating or drinking, or febrile diseases, produce the same effect as causes operating from without.

In either case, the sleep or torpitude produced is sound or healthy under a certain degree of exhaustion alone: hence, mankind sleep most refreshingly after moderate or accustomed fatigue, moderate or accustomed study, moderate or accustomed meals.

If the stimulus be a little increased beyond this medium, an undue and morbid proportion of sensorial power is secreted, which postpones, indeed, the torpitude or sleep for the present, but at the expense of the general strength of the system, and an expense to which the vital organs themselves contribute something: whence a far deeper and heavier sleep or torpitude ensues than would have ensued with less proportion of fatigue. If such torpitude take place before the vital organs are totally exhausted, it is confined to the organs of sense alone, which hereby progressively recover their accustomed activity and vigour .But if the vital organs be also exhausted before the torpitude ensues, it will be propagated to themselves, the living principle will cease, and the sleep will be the sleep of death. Violent and continued pain or labour, as external stimuli, violent and continued fevers, violent and continued grief, a very inordinate debauch, as internal stimuli, are all liable to produce these effects: and the one or the other will take place in proportion to their excess and extremity.

If a stimulus affecting the organs of sense, at which end soever applied, be intolerably pungent or forcible, the sensorial power will be exhausted immediately, and the organ directly affected will become instantly torpid. Hence sounds, intolerably loud, make us deaf; excessive light blinds us; acrimonious smells or savours render us incapable of smelling or tasting. And hence an abrupt shock of joy or grief, a sudden and intense paroxysm of fever, large quantities of wine or spirits, as internal causes, produce morbid lethargy, palsy, apoplexy, which are only so many modifications of the sleep, or torpitude of the sensitive and irritative fibres. If the same abrupt and violent cause be sufficient to act upon the vital organs, as well as upon those of external sensation, the torpor becomes universal, and the sleep is once more the sleep of death. It is in this manner that death is produced by a stroke of lightning.

As violent stimuli produce sudden and occasionally irrecoverable torpitude, either general or local, stimuli less violent induce a tendency to the same effect. Hence the nostrils of persons not accustomed to snuff are more forcibly agitated by its application, than those that have been in the use of it: the eyes of persons accustomed to sleep in the glare of the sun, find no inconvenience from exposure to the light of the morning; while those who usually sleep in total darkness are awoke by its stimulus. And so of the rest.

On this account a very small portion of light, of sound, or of exercise, are sufficient sources of exhaustion to those who are not in the habit of using great external or internal activity. Hence savages, and quadrupeds, who use but very little internal activity, and no more external activity than is necessary to gratify their passions and satisfy their hunger, become torpid upon very slight excitements. Hence infants become exhausted upon still slighter excitements; as the exercise of being carried, the mere breath of the air, or the digestion of milk alone in the stomach; either of which, but especially the whole collectively, is sufficient to make them sleep soundly:—so soundly, indeed, that no common stimulus is able for a long time to rouse them from their torpor. In other words, it requires a period of many hours for the external organs to recover from their exhaustion. The smallest undulatory motion in the uterus, perhaps, or the very action of the vital organs themselves, may be sufficient to wear out, from time to time, the sensorial power of the fetus on its first formation: and hence the fetus sleeps, with few intermissions, through the whole period of parturition.

For the same reason, persons in advanced age are far less impressed by common stimuli than in any former part of their lives; from a long series of exposure to their influence, the organs of sense are become more torpid, and hence they require less sleep, and at the same time less food. The vital organs partake of the same disposition, and they are in consequence less liable to violent or inflammatory disorders. But the general torpitude increasing, the heart is stimulated with greater difficulty; a smaller portion of sensorial fluid is secreted by the brain; a smaller portion of nutriment is thrown into the circulation from the digestive organs: the pulse and every other power gradually declines, till at length, if ever man were to die of old age alone, he would die from a total torpor or paralysis of the heart. But debilitated as every organ is become long before such a period can arrive, the general frame is incapable of resisting the smallest of the more trivial shocks, whether external or internal, to which man is daily exposed: in other words, there is no reservoir of sensorial power to supply the local or temporary demand; and the man dies, even at last, from sudden exhaustion, rather than from progressive paralysis.

Sleep, then, is a natural torpitude or inertness, induced upon the organs of the body, and the faculties of the mind, by fatigue and exhaustion; and, in a physiological survey, consists of the three stages of slumber, dreaming and lethargy. In slumber, the exhaustion is slight, and is almost confined to the organs of external sense, the will only inclining to their inertness: in dreaming, the exhaustion is usually more considerable, the will altogether associating in their inertness: in lethargy, the exhaustion extends to and embraces the mental faculties. When the system is under the influence of disease, the usual course of the phænomena of sleep and dreaming is often disturbed and interrupted; and when the torpitude extends to the vital organs, the effect produced is death.

But the chief difficulty in the subject of dreaming remains still to be accounted for. How is it possible for thoughts or ideas to exist in the brain, and be continued while the will, which usually regulates them, and the external senses which give birth to them, have their continuity of action broken in upon? I shall endeavour to explain this difficulty in language as familiar as I can employ.

A certain, but a very small degree of stimulus applied to any of the cerebral fibres of the human body, whether sensitive or irritative, instead of sensibly exhausting them, seems rather to afford them pleasure; at least the fibres are able to endure it without becoming torpid, or which is the same thing, requiring sleep or rest.

Hence every gentle sight, and every gentle sound, or any other gentle object in nature, to what sense soever it be directed; the still twilight of a summer evening; the mild lustre of the moon, interwoven with the foliage of forest-scenery; the reposing verdure of a spreading lawn; soft playful breezes; the modest fragrance of roses and violets; the light murmurs of a rippling stream; the tinkling of a neighbouring sheep-fold, and the sound of village bells at a distance, are all stimuli that produce no sensible exhaustion; and, on this very account, form some of the most agreeable images in nature. In like manner, the orbicular motion of the lips in a sucking infant, is a source of so much comfort, and attended with so little exhaustion, that whether sleeping or waking, it will generally be found mimicking the action of sucking, when at a distance from its nurse; and, perhaps, not thinking of such action itself. A person who, from habit, has acquired a particular motion of any one of his limbs, a twirl of the fingers, or a swinging of one leg over the other, perseveres in such motion from habit alone, and feels no torpitude or exhaustion in the fibres that are excited, although it might be intolerably fatiguing to another who has never acquired the same custom.

It is probable, then, that thought, and the action of the vital organs, are of this precise character. We are totally ignorant, indeed, of the mysterious mode by which either the one or the other was produced at first; but we see enough to convince us that the stimulus is, in both cases, equally pleasing and gentle. And hence both actions continue without exhausting us, except when unduly roused; and form a habit too pertinacious to be broken through by any ordinary opposition.

Thought, then, is to the sensory that which the motions I have just spoken of are to the muscles which are the subjects of them. Both continue alike, whether we be reflecting upon the habit or not: but the habit of thinking is so much older, and consequently so much deeper rooted than that of any kind of muscular motion, except the muscular motion of the vital organs, that it is impossible for us to subdue it by the utmost efforts of the will: whence, like the action of the vital organs, it accompanies us, not only at all times when awake, but in all ordinary cases during sleep, and is the immediate and necessary cause of our dreaming.

Thought can only be exercised upon perceptions introduced into the sensory by the organs of external sense; and hence the chief bent of our thoughts must be derived, whether sleeping or waking, from the objects or perceptions that most deeply impress us. The train of thoughts, then, that recurs from habit alone, as in sleep or total retirement from the world, must generally be of this description: in the former case, however, by no means correctly or perfectly; because, there are others also which have a tendency to recur, and neither the will or the senses are in action to regulate or repress them. Whence, as I have already observed, proceeds a combination of thoughts or ideas, sometimes only in a small degree incongruous, and at other times most wild and heterogeneous; occasionally, indeed, so fearful and extravagant as to stimulate the senses themselves into a sudden renewal of their functions, and consequently to break off abruptly the sleep into which they were thrown.

Let us pursue this train of reasoning, and it will lead us to account, if I mistake not, for some of the most extraordinary facts that are connected with the recondite subject of sleep and dreaming.

I have just observed that the stimulus of our ideas in dreaming is often sufficient to rouse the external senses generally, and to awake us all of a sudden. But this stimulus may also be of such a kind and just such a strength, as to excite into their accustomed action the muscles of those organs or members only which are more immediately connected with the train of our dreams, or incoherent thoughts, while every other organ still remains torpid. And hence, the muscles chiefly excited being those of speech, some persons talk; and others, the muscles chiefly excited being those of loco-motion, walk in their sleep, without being conscious on their waking of any such occurrence.

Whatever be the set of fibres that have chiefly become exhausted from the labour or stimulus of the day, the rest, as I have already noticed, partake of the torpitude from a habit of association; exhausted in some degree also themselves, by the share of sensorial power which, as from a common stock, they have contributed towards the support of the debilitated organ. But it sometimes happens, either from disease or peculiarity of constitution, that all the organs of external sense do not associate in such action, or yield alike to the general torpor of the frame: and that the auditory, the optical, or some other sense, continues awake or in vigour while all the other senses are become inert; as it does also that such particular sense, like the muscles of particular members, as observed just above, is awoke or re-stimulated into action in the midst of the soundest sleep, by the peculiar force and bent of the dream, while all the rest continue torpid.

If the organ of external sense thus affected with wakefulness be that of *hearing*, a phænomenon may occur which has often been noticed as far back, indeed, as the times of the Greek and Roman poets, but which has never hitherto, I believe, been satisfactorily explained; the dreamer may in this case hear a by-stander, who speaks to him; and if, from a cause above specified, he should also have happened to talk in his sleep, so as to give the by-stander some clue into the train of thoughts of which his dream is composed, a conversation may be maintained, and the by-stander, by dexterous management, and the assumption of a character which he finds introduced into the dream, may be able to draw from the dreamer the profoundest secrets of his bosom; the other senses of the dreamer, instead of hereby rousing to detect the imposition, being plunged into a still deeper torpitude, from the demand of an increased quantity of sensorial power to support the exhaustion which the wakeful or active organ is, in consequence, sustaining. This, however, is a case of rare occurrence, though it seems to have occurred occasionally.

If the wakeful organ be that of *sight*, and the dreamer, from a cause just adverted to, be accustomed to walk instead of to talk in his sleep, he will be able to make his way towards any place to which the course of his dream may direct him, with perfect ease, and without the smallest degree of danger. He will see more or less distinctly, in proportion as the organ of sight is more or less awake; yet from the increased exhaustion, and of course increased torpor of the other organs, in consequence of an increased demand of sensorial power from the common stock to support the action of the sense and muscles immediately engaged, every other sense must necessarily be thrown into a deeper sleep or torpor than on any other occasion. Hence the ears will not be roused even by a sound that might otherwise awake him; he will be insensible, not only to a simple touch, but to a severe shaking of the limbs: and may even cough violently without being recalled from his dream. Having accomplished the object of his pursuit, he may safely return, even over the most dangerous precipices, for he sees them distinctly, to his bed: and the organ of sight, being now quite exhausted, or there being no longer any occasion for its use, may once more associate in the general torpor, and the dream take a new turn, and consists of a new combination of images.

The view we have thus taken of sleep and dreaming will explain a variety of other curious phænomenon in natural philosophy, which have usually been supposed of very difficult elucidation.

What is REVERY? It is the dream of a man while awake. He is so intently bent upon a particular train of thought, that he is torpid to every thing else: he sees nothing, he hears nothing, he feels nothing; and the only difference between the two is, that in common dreaming, the sensitive and irritative power of the external senses is exhausted progressively and generally, while the will partakes of the exhaustion; and that in revery the whole is directed to a single outlet, the will, instead of being exhausted, being revetted upon this one point alone; and the external senses being alone rendered torpid from the drain that is thus made upon them to support the superabundant flow of sensitive and irritative power expended upon the prevailing ecstasy.

It was my intention to have cited a few singular instances of this wonderful aberrancy of the mind; and to have followed them up with a momentary glance at those interesting subjects so closely connected with it, night-mare, delirium, madness, idiotism; but the time will by no means allow me, and I hasten to close with a few observations upon winter-sleep, and the revivification of certain animals after their appearing to be dead.

Upon a general survey of the preceding observations, it should follow that every part of the animal system may safely sleep or become torpid except the vital organs, or those that act independently of the will; and that the moment these participate in the torpor the principle of life ceases, and the spirit separates from the body. Why the principle of life should even then cease we know not, for we know not what produced its union at first. There are various circumstances, however, which prove that this, though a general rule, is not a rule without its exceptions. We have all heard and read of such extraordinary occurrences as trances, or apparent absences of the soul from the body: we have heard and read of persons who, after having been apparently dead for many days, and on the point of being buried, have returned to a full possession of life and health; and although most of these histories are wrapt up in so much mystery and superstition, as to be altogether unworthy of notice, there are many too cautiously drawn up and authenticated to be dismissed in so cursory a manner. But let us proceed to a few facts of a similar, yet of a more extraordinary kind, and which are or may be within the personal knowledge of every one.

In cases of suspended animation by hanging, drowning, or catalepsy, the vital principle continues attached to the body after all the vital functions cease to act, often for half an hour, and sometimes for hours. In the year 1769, Mr. John Hunter, being then forty-one years of age, of a sound constitution, and subject to no disease except a casual fit of the gout, was suddenly attacked with a pain in the stomach, which was shortly succeeded by a total suspension of the action of the heart and of the lungs. By the power of the will, or rather by violent striving, he occasionally inflated the lungs, but over the heart he had no control whatever: nor, though he was attended by four of the chief physicians in London from the first, could the action of either be restored by medicine. In about three quarters of an hour, however, the vital actions began to return of their own accord, and in two hours he was perfectly recovered. "In this attack," observes Mr. (now Sir Everard) Home, who has given an interesting memoir of his life, "there was a suspension of the most material involuntary actions:

even involuntary breathing was stopped: while sensation with its consequences, as thinking and acting, with the will, were perfect, and all the voluntary actions were as strong as before."

In the whole history of man I do not know of a more extraordinary case. The functions of the soul were perfect, while the most important functions of the body, those upon which the life depends absolutely, in all ordinary cases, were dead for nearly an hour. Why did not the soul separate from the body? and why did not the body itself commence that change, that subjection to the laws of chemical affinity, which it evinces in every ordinary case of the death or inaction of the vital organs? Because in the present instance, as in every instance of suspended animation from hanging or drowning, the vital principle, whatever it consists in, had not ceased, or deserted the corporeal frame. It continued visible in its effect, though invisible in its essence and mode of operation.

Let us apply this remark to the subject immediately before us: it will serve as a ready clue to its intricacies. In many animals, then, and in most vegetables, the living principle often continues in the same manner to reside in, and to actuate the organic frame; while the vital functions, as they are called, and in conjunction with these, all the other functions of the system, remain inactive, not for an hour only, but for months and sometimes for years. It does so in the seeds of plants, and the eggs of animals, so long as they are capable of germinating or pullulating. It does so in most animals, and perhaps in all vegetables, that sleep or become torpid during the winter-season; for though in a few hybernating animals, as the hedge-hog and Alpine marmot, we trace a small degree of corporeal action from their appearing thinner or returning to activity in the spring, the greater number, like dormice and squirrels, exhibit no diminution whatever. It does so, in a more extraordinary manner, in the ears of blighted corn; which, though incapable of filling and fattening, and seemingly lifeless and effete, still contain a seed that may be rendered productive of a sound and healthy increase. It does so in various species of the moss; in various species of the snail, in one or two of the snake, in the wheel-polype, sloth, and tile-eel, and a variety of other animals and animalcules, that, like many of the preceding, have been kept apparently dead and in the form of dried preparations, totally destitute of irritability, altogether withered, and in substance as hard as a board for months and years,—in some instances as long as twenty years,—and have afterward been restored to life and activity upon the application of warmth, moisture, or some other appropriate stimulus.*

These are extraordinary facts, and may be difficult to be comprehended: but they are facts nevertheless, and may be proved at any time and by any person. But there is a fact still more extraordinary, and of infinitely higher moment; and one in which we are all infinitely more interested—a fact to which these remarks naturally lead, and which they may serve in some degree to illustrate; it is the termination of the sleep of death, the resurrection of the body from the grave.

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* Snails revived after being dried fifteen years and more.—Phil. Trans. 1774, p. 432. See also Mr. Baner's Croonian Lecture "On the Suspension of the Muscular Powers of the Vibrio Tritici."—Phil. Trans. 1823. Art. 1. He has revived this curious worm after perfect torpitude and apparent death for five years and eight months, merely by soaking it in water.

LECTURE VIII.

ON VOICE AND LANGUAGE; VOCAL IMITATION; AND VENTRILOQUISM.

Language, in the fullest scope of the term, is of two kinds; natural and articulate or artificial. The first belongs to most animals; the last is peculiar to man: it is his great and exclusive prerogative. This also is of two divisions; oral or vocal, which constitutes *speech;* and literal or legible, which constitutes *writing*. The first of these divisions shall form our subject for the present study; the second we will examine in a subsequent lecture.

At the root of the tongue lies a minute semi-lunar shaped bone, which from its resemblance to the Greek letter *υ*, or upsilon, is called the hyoid or u-like bone; and immediately from this bone arises a long cartilaginous tube, which extends to the lungs, and conveys the air backward and forward in the process of respiration.* This tube is denominated the trachea or windpipe; and the upper part of it, or that immediately connected with the hyoid-bone, the larynx: and it is this upper part or larynx alone that constitutes the seat of the voice.

The tube of the larynx, as short as it is, is formed of five distinct cartilages; the largest, and apparently, though not really, lowermost of which, produces that acute projection or knot in the anterior part of the neck, and especially in the neck of males, of which every one must be sensible. This is not a complete ring, but is open behind; the open space being filled up, in order to make a complete ring, with two other cartilages of a smaller size and power; and which together form the glottis, as it is called, or aperture out of the mouth into the larynx. The fourth cartilage lies immediately over this aperture, and closes it in the act of swallowing, so as to direct the food to the esophagus, another opening immediately behind it, which leads to the stomach. These four cartilages are supported by a fifth, which constitutes their basis; is narrow before, and broad behind, and has some resemblance to a seal-ring. The larynx is contracted and dilated in a variety of ways by the antagonist power of different muscles, and the elasticity of its cartilaginous coats; and is covered internally with a very sensible, vascular, and mucous membrane, which is a continuation of the membrane of the mouth.

The organ of the voice, then, is the larynx, its muscles, and other appendages; and the voice itself is the sound of the air propelled through and striking against the sides of its glottis, or opening into the mouth. The shrillness or roughness of the voice depends on the internal diameter of the glottis, its elasticity, mobility, and lubricity, and the force with which the air is protruded. Speech is the modification of the voice into distinct articulations, in the cavity of the glottis itself, or in that of the mouth, or of the nostrils.

Those animals only that possess lungs, possess a larynx, and hence none but the three first classes in the Linnéan system, consisting of mammals, birds, and amphibials. Even among these, however, some genera or species are entirely dumb, as the myrmecophaga, or ant-eater, the manis or pangolin, and the cetaceous tribes, together with the tortoise, lizards, and serpents; while others lose their voice in particular regions: as the dog is said to do in some parts of America,* and quails and frogs in various districts of Siberia.†

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* Stud. of Med. i. p. 457. edit. i.

It is from the greater or less degree of perfection with which the larynx is formed in the different classes of animals that possess it, that the voice is rendered more or less perfect; and it is by an introduction of super-added membranes, or muscles, into its general structure, or a variation in the shape, position, or elasticity of those that are common to it, that quadrupeds and other animals are capable of making those peculiar sounds, by which their different kinds are respectively characterized, and are able to neigh, bray, bark, or roar; to pur, as the cat and tiger kind, to bleat as the sheep, or to croak as the frog.

The larynx of the bird class is of a very peculiar form, and admirably adapted to that sweet and varied music with which we are so often delighted in the woodlands. In reality, the whole extent of the trachea or wind-pipe in birds may be regarded as one vocal apparatus; for the larynx is divided into two sections, or may rather, perhaps, be considered as two distinct organs; the more complicated, or that in which the parts are more numerous and elaborate, being placed at the bottom of the treachea, where it divides into two branches, one for each of the lungs; and the simpler, or that in which the parts are fewer, and consist in those not included in the former, occupying its usual situation at the upper end of the trachea, which however is without an epiglottis; the food and other substances being incapable of entering the aperture of the glottis from another contrivance. The lungs, trachea, and larynx of birds, therefore, may be regarded as forming a complete natural bagpipe; in which the lungs constitute the pouch, and supply the wind; the trachea itself the pipe; the inferior glottis the reed, or mouth-piece, which produces the simple sound; and the superior glottis the finger-holes, which modify the simple sound into an infinite variety of distinct notes, and at the same time give them utterance.

Here, however, as among quadrupeds, we meet with a considerable diversity in the structure of the vocal apparatus, and especially in the length and diameter of the tube or trachea, not only in the different species, but often in the different sexes of the same species, more particularly, among aquatic birds. Thus the trachea is straight in the tame or dumb swan (anas *Olor*) of both sexes; whilst in the male musical swan (anas *Cygnus*), it winds into a large convolution contained in the hollow of the sternum. In the spoon-bill (platalea *Leucorodia*), as also in the mot-mot pheasant (phasianus *Mot-mot*), and some others, similar windings of the trachea occur, not enclosed in the sternum. The males of the duck and merganser (Anas and Mergus), have, at the inferior larynx, a bony addition to the cavity, which contributes to strengthen their voice.

Many of the frog genus have a sac or bag in the throat, directly communicating with the larynx, as the tree frog (rana *arborea*), while the green frog (rana *esculenta*) has two considerable pouches in the cheeks, which it inflates, at the time of coupling, by two openings close to the glottis. And it is on this account they are able to give forth that kind of croaking music which they generally begin in the evening and continue through the greater part of the night. Two or three species, possessed of a similar kind of apparatus, are very clamorous animals; and, pretending to a knowledge of the weather, are peculiarly noisy before rain or thunder-storms; while several, as the jocular and laughing toad (rana *risibunda* and r. *bombina*) are of a merrier mood, and seem to imitate with tolerable exactness the laugh of the human voice, in the hey-dey of their activity, which is always in the evening.

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* Pennant, Arctic Zool.

† Muller, Collect. of Russian Discoveries, vol. vii. p. 123.

Among the bird tribes there are some possessed of powers of voice so singular, independently of that of their own natural music, that I cannot consent to pass them over in total silence. The note of the pipra *musica*, or tuneful manakin, is not only intrinsically sweet, but forms a complete octave; one note succeeding another in ascending, and measured intervals, through the whole range of its diapason. This bird is an inhabitant of St. Domingo, of a black tint, with a blue crown and yellow front and rump; about four inches long, very shy, and dexterous in eluding the vigilance of such as attempt to take it. The imitative power of several species of the corvus and psittacus kinds is well-known; the jays and parrots are those most commonly taught, and the far-famed parrot of the late Colonel O'Kelly, which could repeat twenty of our most popular songs, and sing them to their proper tunes, has been, I suppose, seen and heard by most of us. The bulfinch (loxia *Pyrrhula*), however, has a better voice, as well as a more correct taste in copying musical tones, and the bird-breeders of Germany find a lucrative employment in training multitudes of this family for a foreign market.

The talents of the nightingale (motacilla *Lucina*) for speaking, are, likewise, said to be very extraordinary, and even equal to his talents for singing. But where is the man, whose bosom burns with a single spark of the love of nature, that could for one moment consent that this pride and delight of the groves should barter away the sweet wildness of its native wood-notes for any thing that art can offer in its stead?

There is no species, however, so much entitled to notice on account of its voice, as the polyglottus, or mocking-bird. This is an individual of the thrush kind; its own natural note is delightfully musical and solemn; but beyond this it possesses an instinctive talent of imitating the note of every other kind of singing bird, and even the voice of every bird of prey so exactly as to deceive the very kinds it attempts to mock. It is moreover playful enough to find amusement in the deception; and takes a pleasure in decoying smaller birds near it by mimicking their notes, when it frightens them almost to death, or drives them away with all speed, by pouring upon them the screams of such birds of prey as they dread.

Now it is clear that the imitative, like the natural voice, has its seat in the cartilages and other moveable powers that form the larynx: for the great body of the trachea only gives measure to the sound, and renders it more or less copious in proportion to its volume. It is not, therefore, to be wondered at, that a similar sort of imitative power should be sometimes cultivated with success in the human larynx; and that we should occasionally meet with persons, who, from long and dexterous practice, should be able to imitate the notes of almost all the singing-birds of the woods, or the sounds of other animals, or even to personate the different voices of orators and other public speakers.

One of the most extraordinary instances of this last kind consists in the art of what is called VENTRILOQUISM,* of which no very plausible explanation has hitherto been offered to the world. The practitioner of this occult art is well known to have a power of modifying his voice in such a manner as to imitate the voices of different persons conversing at a considerable distance from each other, and in very different tones. And hence the first impression which this ingenious trick or exhibition produced on the world, was that of the artist's possessing a double or triple larynx; the additional larynxes being supposed to be seated still deeper in the chest than the lowermost of the two that belong to birds: whence indeed the name of VENTRILOQUISM OR BELLY-SPEAKING. Mr. Gough has attempted, in the Memoirs of the Manchester Society, to resolve the whole into the phænomena of echoes; the ventriloquist being conceived by him on all occasions to confine himself to a room well disposed for echoes in various parts of it, and merely to produce false voices by directing his natural voice in a straight line towards such echoing parts, instead of in a straight line towards the audience; who, upon this view of the subject, are supposed to be artfully placed on one or both sides of the ventriloquist. It is sufficient to observe, in opposition to this conjecture, that it does not account for the perfect quiescence of the mouth and cheeks of the performer while employing his feigned voices; and that an adept in the art, like Mr. Fitzjames, or Mr. Alexander, is wholly indifferent to the room in which he practises, and will allow another person to choose a room for him. Mr. Fitzjames is a native of France; and his vocal arts and vocal powers have been paid particular attention to by M. Richerand, one of the most popular French physiologists of the day; who has also examined the vocal organs of other ventriloquists, and observes, as the result of his investigations, that although there is little or no motion in the cheeks during the art of speaking, there is a considerable demand and expenditure of air; the ventriloquist always inhaling deeply before he commences his deception, passing a part of the air thus inhaled through his nostrils, and being able to continue his various voices as long as the inspired air may last, or till he has inhaled a fresh supply.

This view of the subject induced M. Richerand to relinquish the old hypothesis of a kind of vocal organ being seated in the stomach, to which we have already adverted, and which he had formerly embraced; though it does not appear that he has very distinctly adopted any other in its stead: "At first," says he, "I had conjectured that a great part of the air expelled by expiration, did not pass out by the mouth and nostrils, but was swallowed and carried into the stomach; and, being reflected in some part of the digestive canal, gives rise to a real echo; but having afterwards more attentively observed this curious phænomenon in Mr. Fitzjames, who exhibits it in its greatest perfection, I was soon convinced that the name of *ventriloquism* is by no means applicable; since the whole of its mechanism consists in a slow gradual expiration; in which the artist either influences at his will the surrounding muscles of the chest, or keeps down the epiglottis by the base of the tongue, the point of which is not protruded beyond the arch of the teeth."†

M. De la Chapelle, without offering any particular explanation of this curious art, published, in 1772, an ingenious work, in which he attempted to prove that ventriloquism is of a very ancient date; and that it formed the mode by which the responses of many of the oracles of former times were delivered by the priests and priestesses to the credulous multitude around them. And although this able writer has not fully succeeded in establishing his point, it must be allowed by every one that no art, while it continued occult, could better answer the purpose of such a sort of imposition; for an adept in the science is capable of modulating and inflecting his voice with so nice a dexterity, as not only to imitate, with equal accuracy, the cries of dogs, cats, infants, and persons in distress, together with every modification of articulate speech, but apparently to throw the mimic sound from whatever quarter he chooses: from the ceiling or roof of a house; the corner of a room; the mouths, stomachs, or pockets of any of the company present; from their hands or feet, from beneath a hat or a glass, or from a wooden doll. A humorous artist of this kind is said to have amused himself some years ago, by frequenting the fish-market at Edinburgh, and making a fish appear to speak, and give the lie to its vender in her own gross phrasing, upon her affirming that it was fresh, and caught in the morning; the fish quaintly replying as often as she so asserted, that it had been dead for a week, and that she knew it.

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* Stud. of Med. i. p. 463. edit. i.

† Nouveaux Elemens de Physiologie, in loc. Paris, 1804.

This singular art has given rise to a variety of extraordinary tales, and some of them of a very amusing kind. The following, which I copy from M. Bordeau, a learned critic of the sixteenth century, is of this description, and I will for once break through our accustomed gravity in order to give it you.

The gallant Francis I. of France, had an equally gallant and very shrewd valet de chambre, of the name of Lewis Brabant, who was also a most skilful ventriloquist. Lewis Brabant had the misfortune to fall desperately in love with a young, very beautiful, and very wealthy heiress, whose father forbad his addresses in consequence of the disparity of his condition. The father, however, died soon after, and the courageous lover, unsubdued by a first repulse, was determined to try his fortune a second time, under favour of the new state of circumstances, and to see whether it would not be possible, upon a severe push, to call to his aid the art of ventriloquism, in which he was so considerable an adept.

He accordingly waited upon the mother as soon as decency would allow, and once more submitted his proposals. But faithful to the views of her deceased husband, the mother of the young lady made no scruple of once more giving Lewis Brabant a direct refusal. While, however, she was in the act of doing so, a low, hollow, sepulchral voice was heard by herself, and by every friend who was with her, and which was instantly recognised as the voice of the deceased, commanding her to give her daughter's hand immediately to Lewis Brabant, whom the piteous spirit affirmed he now knew to be a most worthy and excellent man, and considerably wealthier than he had taken him to be when alive; adding, at the same time, that he was at that moment suffering a part of the pains of purgatory for having ill-treated, by his refusal, so exemplary a man; and that he would not be released from them till his widow had consented.

All was mute astonishment; but Lewis Brabant appeared more astonished than the rest. He modestly observed, that whatever his merits or his virtues might be, he had no idea that they were worthy of being commemorated by a voice from the grave; but that nothing could give him more pleasure than to be made the happy instrument of extricating the old gentleman from the pains of purgatory, which it seemed he was suffering on his account. There was no doubt as to the voice; and consequently there was no doubt as to the path to be pursued: the mother, the daughter, the whole family, immediately assented with one accord, and Lewis Brabant had the honour to receive their commands to prepare for the nuptials with all speed.

To prepare for the nuptials, however, required the assistance of a little ready money; but Lewis Brabant was destitute of such an article. It was necessary, nevertheless, to procure it; and he now resolved to try whether the same talent which had obtained for him the promise of a wife, might not also obtain for him the material he stood in need of.

He recollected that there lived at Lyons an old miserly banker of the name of Cornu, who had accumulated immense wealth by usury and extortion, and whose conscience appeared often to be ill at ease, in consequence of the means he had made use of; and it immediately struck him that M. Cornu was the very character that might answer his purpose.

To Lyons, therefore, he went instantly post-haste, commenced an immediate acquaintance with M. Cornu, and on every interview took especial care, on entering into conversation with him, to contrast the pure happiness enjoyed by the man whose conscience could look back, like M. Cornu's, as he was pleased to say, on a life devoted to acts of charity and benevolence, with the horrors of the wretch who had amassed heaps of wealth by usury and injustice, and whose tormented mind only gave him now a foretaste of what he was to expect hereafter. The miser was perpetually desirous of changing the conversation; but the more he tried, the more his companion pressed upon him with it; till finding, on one occasion, that he appeared more agitated than ever, the ventriloquist conceived such an occasion to be the golden moment for putting his scheme into execution; and at that instant a low, solemn, sepulchral mutter was heard, as in the former case, which was at last found to be the voice of M. Cornu's father, who had been dead for some years, and which declared him to have passed all this time in the tortures of purgatory, from which he had now just learned that nothing could free him but his son's paying ten thousand crowns into the hands of Lewis Brabant, then with him, for the purpose of redeeming Christian slaves from the hands of the Turks.

All, as in the last case, was unutterable astonishment; but Lewis Brabant was the most astonished of the two: modestly declared that now for the first time in his life he was convinced of the possibility of the dead holding conversation with the living: and admitted that, in truth, he had for many years been benevolently employed in redeeming Christian slaves from the Turks, although his native bashfulness would not allow him to avow it publicly.

The mind of the old miser was distracted with a thousand contending passions. He was suspicious without having any satisfactory reason for suspicion; filial duty prompted him to rescue his father from his abode of misery; but ten thousand crowns was a large sum of money even for such a purpose. He at length resolved to adjourn the meeting till the next day, and to change it to another place. He required time to examine into this mysterious affair, and also wished, as he told his companion, to give his father an opportunity of trying whether he could not bargain for a smaller sum.

They accordingly separated; but renewed their meeting the next day with the punctuality of men of business. The place made choice of by M. Cornu for this rencontre, was an open common in the vicinity of Lyons, where there was neither a house, nor a wall, nor a tree, nor a bush, that could conceal a confederate, even if such a person should be in employment. No sooner, however, had they met than the old banker's ears were again assailed with the same hideous and sepulchral cries, upbraiding him for having suffered his father to remain for four and twenty hours longer in all the torments of purgatory; denouncing that, unless the demand of the ten thousand crowns was instantly complied with, the sum would be doubled; and that the miser himself would be condemned to the same doleful regions, and to an increased degree of torture. M. Cornu moved a few paces forward, but he was assaulted with still louder shrieks: he advanced a second time, and now, instead of hearing his father's voice alone, he was assailed with the dreadful outcry of a hundred ghosts at once, those of his grandfather, his great grandfather, his uncles and aunts, and the whole family of the Cornus for the last two or three generations; who, it seems, were all equally suffering in purgatory—and were included in the general contract for the ten thousand crowns; all of them beseeching him in the name of every saint in the calendar to have mercy upon them, and to have mercy upon himself. It required more fortitude than M. Cornu possessed to resist the threats and outcries of a hundred and fifty or two hundred ghosts at a time. He instantly paid the ten thousand crowns into the hands of Lewis Brabant, and felt some pleasure that by postponing the payment for a day, he had at least been able to rescue the whole family of the Cornus for the same sum of money as was at first demanded for his father alone. The dexterous ventriloquist, having received the money, instantly returned to Paris, married his intended bride, and told the whole story to his sovereign and the court, very much to the entertainment of all of them.

It is certain, that hitherto no satisfactory explanation has been offered of this singular phænomenon; and I shall, therefore, take leave to suggest, that it is, possibly, of a much simpler character than has usually been apprehended; that the entire range of its imitative power is confined to the larynx alone, and that the art itself consists in a close attention to the almost infinite variety of tones, articulations, and inflections the larynx is capable of producing in its own region, when long and dexterously practised upon, and a skilful modification of these effects into mimic speech, passed for the most part, and whenever necessary, through the cavity of the nostrils, instead of through the mouth. The parrot, in imitating human language, employs the larynx and nothing else; as does the mocking-bird, the most perfect ventriloquist in nature, in imitating cries and intonations of all kinds.

But the parrot and the mocking-bird, it may, perhaps, be said, open their mouths, and employ their tongues, which the ventriloquist, on many occasions, does not do; and that hence the organ of the tongue is equally necessary to inarticulate and to articulate language.

Such, I well know, is the general opinion; but it is an opinion opposed by a variety of incontrovertible facts, and facts of a most important and singular nature, though they have seldom been attended to as they deserve.

Every bird-breeder knows that it is not necessary for birds to open their bills in the act of singing, except for the purpose of uttering the note already formed in the larynx, that would otherwise have to pass through the nostrils, which, in birds, prove a much less convenient passage for sound than in man; and of so little use is the tongue towards the formation of sound, that instances are not wanting of birds that have continued their song after they have lost the entire tongue by accident or disease. But without dwelling upon these points, which are of subordinate consideration, I pass on to observe, and to produce examples, that it is not absolutely necessary for man himself to be possessed of a tongue, or even of an uvula, for the purpose either of speaking or singing; or for that of deglutition or taste. In a course of physiological study, and in a lecture upon the nature and instruments of the voice, this is an inquiry, not only of grave moment, but immediately issuing from the subject before us.

Among almost innumerable instances of persons who have been able to articulate and converse without a tongue, too loosely recorded in ancient times to be fully depended upon, we occasionally meet with examples that are far better entitled to our credit. Such is the assertion of the emperor Justin,[*] who affirms, that he had seen venerable men "whose tongues having been cut out at the root, complained bitterly of the torture they had suffered;" and who tells us, in another place, of some others, upon whom Honorichius, king of the Vandals, had exercised the same barbarity; and who had, notwithstanding, "perfectly retained their speech."[†]

Upon the irruption of the Turks into Austria, in 1683, this cruelty was again put in practice upon many of those who unfortunately fell into their hands. Tulpius, whose veracity no man will lightly impeach, was at this time informed that one of the sufferers had escaped, and had recovered, and was still in possession of the use of speech, and residing at Wesop, in Holland; and, half doubtful of the truth of the common report, to Wesop he immediately set off, to satisfy himself by a personal examination. He saw the man, and found that he could not only speak, but could articulate those consonants and words which seem chiefly to depend upon the tip of the tongue for their pronunciation. This is a case the more worthy of attention, because the man had been so cruelly mutilated at the roof of the mouth, that he could not swallow the smallest quantity of food, without thrusting it into the esophagus with his forefinger.[‡]

In the third volume of the Ephemerides Germanicæ, is another case of a similar kind, and most credibly authenticated. It relates to a boy that had lost his tongue at eight years of age by the small-pox, but was still able to speak. The boy was minutely examined in a full court before the members of the University of Saumur, in France, who had suspected some deception; the report, however, was found correct; and the University, in consequence, gave their official attestation to it, in order that posterity might have no room to doubt its validity.

To these let me add one more instance that occurred in our own country, in what may be almost called our own day, and which is very minutely detailed and authenticated in the Transactions of the Philosophical Society that were published between the years 1742 and 1747.[§] The case, as drawn up by Dr. Parsons, relates to a young woman of the name of Margaret Cutting, of Wickham Market, near Ipswich, in Suffolk, who, when only four years old, lost the whole of her tongue, together with the uvula, from what is said to have been a cancerous affection; but who still retained the power of speech, deglutition, and taste, without any imperfection whatever; articulating, indeed, as fluently, and with as much correctness as other persons; and, like the individual whose history is given by Tullius, articulating those peculiar syllables which ordinarily require the express aid of the tip of the tongue for exact enunciation. She also sang to admiration, and still articulated her words while singing, and could

[*] Con. Tit. de Off. Præt.

[†] Phil. Trans. 1742. p. 143; id. 1747. 621; in the Abridgment, viii. 586; ix. 375.

[‡] Tulpii Observ. Medicæ Amsterd.

[§] In their abridged form, vol. viii. 586. and ix. 375.

form no conception of the use of a tongue in other people. Neither were her teeth, in any respect, able to supply the place of the deficient organs; for they were but few in number, and rose scarcely higher than the surface of the gums, in consequence of the injury to their sockets from the disease that had destroyed the tongue. The case thus introduced before the Royal Society, was attested by the minister of the parish, a medical practitioner of repute, and another respectable person. From its singularity, however, the Society evinced a commendable tardiness of belief. They requested another report upon the subject, and from another set of witnesses, whom they themselves named for the purpose; and for whose guidance they drew up a line of categorical examination. This second report soon reached the Society, and minutely coincided with the first; and to set the question completely at rest, the young woman was shortly afterwards brought to London, and satisfied the Royal Society in her own person.[*]

It appears obvious, then, that the tongue, though a natural and common organ in the functions of voice, taste, and deglutition, is not absolutely necessary to these functions: that on various occasions it has been, and, therefore, may be, totally lost, while the functions themselves continue perfect.

In singing, every one knows that the larynx is the only organ employed, except when the tones are not merely uttered but articulated: it is the only organ employed, as I have already observed, in the mock articulations of parrots and other imitative birds; it is the only organ of all natural tones, or natural language; and hence Lord Monboddo ingeniously conjectures, that it is the chief organ of articulate language in its rudest and most barbarous state. "As all natural cries," he observes, "even though modulated by music, are from the *throat and larynx, or part of the throat, with little or no operation of the organs of the mouth;* it is natural to suppose that the first languages were, for the greater part, *spoken from the throat;* and that what consonants were used to vary the cries, were mostly *guttural;* and that the organs of the mouth would at first be but very little employed."[†]

I have thus endeavoured to account for the chief difficulty, and the most extraordinary phænomenon that occurs in the art of Ventriloquism,[‡] that I mean of speaking without appearing to speak, on discovering any motion of the lips: the larynx alone, by long and dexterous practice, and perhaps by a peculiar modification in some of its muscles, or cartilages, being capable of answering the purpose and supplying the place of the associate organs of the mouth.

It is this curious power, in the art of ventriloquism, that most astonishes us, and puts us off our guard; for the two other powers connected with it, of imitating various cries or voices, and of appearing to throw the voice from remote objects, are far more common and comprehensible. The power of vocal imitation where the tongue is allowed to be employed is possessed, by most persons, to a certain extent; and, by many, to a degree of accuracy, that would certainly deceive us in the dark; or if, by any other means, the performer was concealed from us. While the only point necessary to give the voice the semblance of issuing from a distant or unusual object, is to take a nice measure of the distance itself, and of the nature of the object from which it is to be presumed to issue, and so to modulate, or inflect it as to produce the natural tone it may be supposed to possess, if thrown from such a distance or from such a form. It must be obvious, however, that the surprise resulting from the mystery of thus imitating voices and distances, must be powerfully aided in ventriloquism by the additional mystery of the artist's motionless mouth; in consequence of which we are totally incapable of referring it to himself. In hearing, as in seeing, habit is our only guide:—in both we only judge by accustomed comparisons; and we are exactly in the same manner deceived by the painter, and even allow ourselves to be deceived, in regard to objects of vision, as we are by the ventriloquist, and without such allowance, in regard to objects of sound. In respect to both senses, indeed, we often deceive ourselves in judging of the most common phænomena: and hence it is not at all to be wondered at that we should be completely imposed upon by the nice delusions of art. Thus the evening sky, begirt with gold-green clouds at the extremity of the horizon, is often mistaken for the ocean, studded with islands; and the rumbling of a cart over pavement, or hard ground, is not unfrequently believed to be a thunder-clap in the heavens; and, under the influence of this last deception, we immediately transfer all the awfulness and magnificence of the celestial meteor to this clumsy piece of machinery, and are as alarmed as if the fiery bolt were about to descend upon us.

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[*] Stud. of Med. i. 499, Edit. i. where other examples are noticed.

[†] Orig. and Progr. of Lang. vol. i. 6. iii. ch. 4.

[‡] According to M. Magendie, whose work first appeared in our own country seven years after the delivery of the above Lecture, in 1811, the larynx is supposed to be the organ chiefly or altogether operated upon in France; and ventriloquism to consist in adjusting the measure of its articulations according to the effects which the ventriloquist has observed that distance, or other circumstances, produce upon the natural voice. See Edin. Med. and Surg. Journ. lxi. 577.

LECTURE IX.

ON NATURAL OR INARTICULATE, AND ARTIFICIAL OR ARTICULATE LANGUAGE.

Having, in our last lecture, examined into the seat and properties of the natural voice, let us now proceed to notice the mode in which it is applied to the formation, first, of natural language, and, next, of speech or artificial language.

Natural language is the instinctive appropriation of certain tones of the natural voice, to indicate certain feelings of the sensory: and with the few exceptions pointed out in our preceding lecture, every animal belonging to the three classes of mammals, birds, and amphibials, every animal possessed of lungs, is in some degree or other possessed of this kind of language. Its scope is, indeed, often very limited; but always sufficient to answer the purposes of nature. The female of every species understands the call of the male, and replies to it as intelligibly: the young understands the mandates of the mother, and the mother, the petitions of the young. This amusing department of natural history was well known to the philosophers of Greece and Rome, and attentively cultivated by them: and Lucretius, in his Nature of Things, has pursued the subject not only so correctly but so copiously, that it is almost impossible, even in the present day, to add any thing of real importance to what he has already observed.

I have termed this language of nature instinctive; and that it is entitled to this character is clear; because, even among birds which possess the widest and most complicated range of natural language of all animals whatever, where two individuals of different species are bred up in the same bush, or in the same cage, or hatched and fostered by a female of a third species, each evinces and retains the note that specifically distinguishes the species to which it belongs. In the case of a goldfinch and a chaffinch this has been put directly to the proof. And it is by this native tongue, as Mr. Montague has justly observed, and not by the form or colour, that the process of pairing is achieved, and the female induced to select her paramour.*

Almost every animal of the three classes just adverted to, exhibits a different tone of voice according to the governing passion of the moment; but more especially when under the influence of *grief*, *fear*, or *joy;* to which, in some instances, we may add *anger;* but a distinct tone for anger is not so generally traced among animals as it is for the three preceding passions.

Among quadrupeds, the elephant, horse, and dog appear to possess the greatest portion of a natural tongue. They are all gregarious, particularly the two former. In Asia, the wild elephant, and in the Ukraine, between the Don and the Nieper, the wild horse, pursue one common plan of political society, in numerous and collected troops; and are regulated by the elders of the tribe among the elephants, and by leaders chosen for this purpose among the horses: and it is by a difference of voice, combined with a difference of gesture, that these superiors give orders, in the course of their travels from place to place, in pursuit of pasture, for the necessary dispositions and arrangements. Both kinds are extremely vigilant and active, and maintain their ranks and brigades with as much regularity and precision as if they were conducted by a human leader. Among the wild horses of the Ukraine, the captain-general seems to be commonly appointed to his station for about four or five years; at the expiration of which time, a kind of new election takes place: every one appears to have a right to propose himself for the office, the ex-magistrate not excepted: if no new candidate offer, the latter is re-elected for the same term of time, and if he be opposed a combat succeeds, and the victor is appointed commander-in-chief.

The conduct pursued by the peaceful and amiable elephant varies in some degree from this of the wild horse; for in the travels of these animals from place to place, the troops are led on by the eldest of the tribe, thus evincing a kind of patriarchal government: the young and feeble marching in the middle, and the rear being composed of the vigorous and adult.†

The natural language of the monkey kind, notwithstanding the general resemblance of their structure to that of the human race, appears to be more confined than that of most quadrupeds; and it is well known, that they never attempt to articulate sounds. Linnéus, indeed, seems to have entertained a contrary opinion with respect to the orang-otang, and asserts that he speaks with a kind of hissing noise. Buffon, however, and

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* Ornithological Dict. Introd. p. xxix.

† See note to the Author's Translation of Lucretius, vol. ii. p. 376.

Daubenton, and almost every other naturalist who has attentively watched his habits, deny that he ever employs even a hissing speech. And every comparative anatomist, who has accurately examined his vocal organs, has declared him to be physically incapable of articulation, from the peculiarity of a sac or bag, in some species of the animal single, in others double, immediately connected with the upper part of the larynx, and into which the air is driven as it ascends from the lungs through the trachea, instead of being driven into the glottis, where alone it could acquire modulation and articulate sounds. From this sac or bag it afterwards passes into the mouth by a variety of small apertures or fissures, by which almost the whole of its force, and consequently of its vocal effect is lost. This peculiar conformation appears first to have been noticed by Galen, who traced it through several varieties both of the ape and monkey families; but for the most correct account of it we are indebted to professor Camper, who, in a paper published in the Philosophical Transactions for 1779, minutely describes it as it exists in the sylvanus or pigmy, in which Tyson had overlooked it; in various other species of the ape; in the cynosurus or dog-tailed monkey; and in many others of the monkey tribe. At all adventures, the monkey has a peculiar deficiency of natural tongue; and we hence obtain an insuperable objection, had we no others, but which I have already shown, are sufficiently abundant,* to the declaration of Lord Monboddo and Linnéus that this tribe are all of the same original stock as man; and their absurd story that man himself is not unfrequently to be met with in some of the Asiatic islands, with a monkey-tail, varying in length from three or four inches to a foot, possessing as great a fluency of speech as in any part of Europe.

Marcgrave, in his history of Brazil, has amused us, with an account of a very extraordinary species of American sapajou, which Linnéus has called Beelzebub, Buffon, Ouarine, and our own countryman, Mr. Pennant, Preacher-monkey, that assemble in large groups every morning and evening, and attentively listen to a loud and long-continued harangue of one of the tribe, whom he seems to suppose a public officer or popular demagogue. Upon the authority of Marcgrave, this species has been admitted into all our books of Natural History; but there are some doubts concerning it, and the description is at least without the support of concurrent testimony.

The different accents of the dog and the horse, when under the influence of rage, desire, or exultation, are too powerful and too common not to have been noticed by almost every one. It is impossible to describe the different tones of the mastiff more precisely than in the words of the truly philosophical poet I have so lately referred to; but as it would be improper to quote him in the original before a popular audience, I must request of you to receive a feeble translation of him in its stead;

> When half enraged,
> The rude Molossian mastiff, her keen teeth
> Baring tremendous, with far different tone
> Threats, than when roused to madness more extreme,
> Or when she barks, and fills the world with roar.
> Thus, when her fearless whelps, too, she with tongue
> Lambent, caresses, and, with antic paw,
> And tooth restrain'd, pretending still to bite,
> Gambols, soft yelping tones of tender love—
> Far different, then, those accents from the din
> Urg'd clamorous through the mansion when alone,

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* Ser. II. Lect. III. On the Varieties of the Human Race.

Or the shrill howl her trembling bosom heaves,
When, with slunk form, she waits the impending blow.[*]

The language of the tiger, leopard, and cat, is not so rich or diversified as that of the dog: but they have still a considerable variation in the scale of their mewings, according to the predominant passion of fear or grief: while these again differ from the accent of simple pleasure, which consists in purring, and very considerably indeed from the loud and dissonant voice of love.

The language of birds is, in almost every instance, strikingly musical, though not equally eloquent, whatever be the passion it describes. To its variety in the different tribes of the osprey, hawk, sea-gull, rook, and raven, and especially as auguring, wet or dry, stormy or serene weather, almost every naturalist has borne testimony: for each can say that

Cawing rooks and kites that swim sublime
In still repeated circles, screaming loud,
The jay, the pie, and e'en the boding owl
That hails the rising moon, have charms for me.
Sounds inharmonious in themselves, and harsh,
Yet heard in scenes where peace for ever reigns,
And only there, please highly for their sake.[†]

Upon the exquisitely varied tones and modulations of the singing-birds we descanted at some length in a former lecture.[‡] But the subject is as interesting as it is inexhaustible; and in the summer season of praise, when the heart of man overflows, or should overflow, with gratitude to his beneficent Creator for the return of plenteousness that meets his eye in every direction, with what animation do they join in the general carol; awakening us at the dawn, accompanying us through the day, and softening and harmonizing, and I fear not to add, spiritualizing our feelings at night-fall.

The robin, and not the lark, as commonly supposed, takes the lead,[§] and seems longing for the day to unclose. His gentle voice is in sweet accordance with the feeble beams of the early twilight; and as soon as the glorious sun makes his appearance, then up mounts the lark, and pours forth his more vigorous song; a thousand warblers hear the call, and the chorus is full and complete. The leaders vary, but the carol continues. The nightingale yet protracts his nocturnal tones; and the thrush, the blackbird, and the goldfinch, from the lofty grove, the close thicket, or the blossomed orchard, intermingle their rival pretensions: while the transient but mellow burst of the cuckoo, adds a richness to the general harmony; and even the croak of the raven, and the chattering of the daw, only break into the symphony, with an occasional discord that heightens the impressive effect. At length the sun is no more: the unbounded concert dies away; and the season of rest returns. It returns, but not with mute silence; for the night is soothed rather than disturbed by the solitary song of the robin, now resuming his modest strain, and yielding in succession to the peeress pipe of the nightingale, and the deep-toned but expressive hoot of the owl.

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[*] Inritata canum quom primum magna Molossum
Mollia ricta fremunt, duros nudantia denteis,
Longe alio sonitu rabies districta minatur,
Et quom jam latrant, et vocibus omnia conplent.
At catulos blande quom lingua lambere tentant,
Aut ubi eos lactant pedibus, morsuque potentes,
Subspensis teneros imitantur dentibus haustus,
Longe alio pacto gannitu vocis adulant,
Et quom desertei baubantur in ædibus, aut quom
Plorantes fugiunt, submisso corpore, plagas.
De Rer. Nat. v. 1063.

[†] Task, book i.

[‡] Ser. II. Lect. I. On Zoological Systems; and the distinctive characters of Animals.

[§] See Jenner, Phil. Trans. 1824, p. 37.

The note of the wren (motacilla *Troglodytes*) is as slender as its form, but it is well worth noticing as being the only note of the feathered creation that is continued throughout the winter. During the season of frost and snow it is, indeed, heard to most advantage; for the fearless little songster then enters the court-yard, the stable, or the dairy, and seeks, in confidence, his food of insects or their larves. It is this that constitutes the little beggar's petition; and where is the heart so hardened as to refuse the request he then offers?

With respect to singing-birds, indeed, of all kinds, we may make this pleasing observation, that, as though chiefly intended, in the general munificence of the great Parent of the human race, to captivate mankind, they almost always reside in their vicinity, and are rarely to be found in the uninhabited parts of the earth.*

But the vocabulary of the common cock and hen, is, perhaps, the most extensive of any tribe of birds with which we are acquainted; or rather, perhaps, we are better acquainted with the extent of its range than with that of any others. The cock has its watch-word for announcing the morning, his love-speech, and his terms of defiance. The voice of the hen, when she informs her paramour that she is disburdened of an egg, and which he instantly communicates from homestead to homestead, till the whole village is in an uproar, is far different from that which acquaints him that the brood is just hatched; and both again are equally different from the loud and rapid cries with which she undauntedly assails the felon fox that would rob her of her young. Even the little chick, when not more than four or five days old, exhibits a harsher and less melodious clacking when offered for food what it dislikes, than when it perceives what it relishes.*

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* The following passage from Dr. Jenner's very admirable paper "On the Migration of Birds," has a passage so directly in accordance with these remarks, that I cannot avoid copying it from the Phil. Trans. for 1824.

"We must observe, that nature never gives one property *only*, to the same individual substance. Through every gradation, from the clod we tread upon to the glorious sun which animates the whole terrestrial system, we may find a vast variety of purposes for which the same body was created. If we look on the simplest vegetable, or the reptile it supports, how various, yet how important in the economy of nature, are the offices they are intended to perform! The migrating bird, I have said, is directed to this island at a certain season of the year to produce and rear its young. This appears to be the grand intention which nature has in view; but in consequence of the observation just made, its presence here may answer many secondary purposes; among these I shall notice the following. The beneficent Author of nature seems to spare no pains in cheering the heart of man with every thing that is delightful in the summer season. We may be indulged with the company of these visiters, perhaps, to heighten, by the novelty of their appearance, and pleasing variety of their notes, the native scenes. How sweetly, at the return of spring, do the notes of the cuckoo first burst upon the ear; and what apathy must that soul possess, that does not feel a soft emotion at the song of the nightingale, (srrely it must be "fit for treasons, stratagems, and spoils") and how wisely is it contrived that a general stillness should prevail while this heavenly bird is pouring forth its plaintive and melodious strains,—strains that so sweetly accord with the evening hour!—Some of our foreign visiters, it may be said, are inharmonious minstrels, and rather disturb than aid the general concert. In the midst of a soft warm summer's day, when the martin is gently floating on the air, not only pleasing us with the peculiar delicacy of its note, but with the elegance of its meandering; when the blackcap is vying with the goldfinch, and the linnet with the woodlark, a dozen swifts rush from some neighbouring battlement, and set up a most discordant screaming. Yet all is perfect. The interruption is of short duration, and without it, the long continued warbling of the softer singing birds would pall and tire the listening ear with excess of melody, as the exhilarating beams of the sun, were they not at intervals intercepted by clouds, would rob the heart of the gayety they for a while inspire, and sink it into languor. There is a perfect consistency in the order in which nature seems to have directed the singing birds to fill up the day with their pleasing harmony. To an observer of those divine laws which harmonize the general order of things, there appears a design in the arrangement of this sylvan mirstrelsy. It is not in the haunted meadow, nor frequented field, we are to expect the gratification of indulging ourselves in this pleasing speculation to its full extent; we must seek for it in the park, the forest, or some sequestered dell, half enclosed by the coppice or the wood."

Before I quit this part of our subject it becomes me also to remark that, even in various other tribes of animals than the three classes to which our observations have hitherto applied, we occasionally meet with proofs of an inferior kind of natural language, though it cannot with propriety be called a language of the voice. And I may here observe, that among the few of these three classes, which we have already noticed as being destitute of a vocal larynx, the bounty of nature has often provided a substitute. Thus the wapiti (cervus *Wapiti* of Barton), though without the sonorous endowment of the horse or ox, seems to have a compensation in an organ that consists of an oblique slit or opening under the inner angle of each eye, nearly an inch long externally, which appears also to be an auxiliary to the nostril; for with this he makes a noise that he can vary at pleasure, and which is not unlike the loud and piercing whistle, that boys give by putting their fingers in their mouth.†

Among insects, however, we find a still more varied talent of uttering sounds, though possest neither of lungs nor larynx, nor the nasal slit of the wapiti. The bee, the fly, the knat, and the beetle, afford familiar instances of this extraordinary faculty. The Sphinx *Atropos*, a species of hawk-moth, squeaks, when hurt, nearly as loud as a mouse; it has even the power, in certain circumstances, of uttering a plaintive note, which cannot fail to excite deep commiseration. If a bee or wasp be attacked near its own hive, the animal expresses its pain or indignation in a tone so different from its usual hum, that the complaint is immediately understood by the hive within; when the inhabitants hurry out to revenge the insult in such numbers, that the offender is fortunate if he escape without a severe castigation.

The cunning spider often avails himself of the natural tone of distress uttered by the fly to make sure of him for his prey. He frequently spreads out his webs or toils to such an extent that he cannot see from one end of them to the other; and often conceals himself in some adjoining crevice where he cannot see the poor animal as it becomes ensnared: but he sits wistfully listening for the buzzing noise that assures him the fly is entangled, and is fluttering to make its escape. He hears the well-known signal, sallies forth from his concealment, and riots on the spoil that has fallen into his power with all the eagerness and ferocity that distinguish the most rapacious quadrupeds.

Whether fishes possess any similar means of communicating their feelings we know not. Reasoning from the facts that a few of them occasionally utter tones of distress when first taken; and that they possess an organ of hearing, and live in a medium well adapted to the propagation of sound, it is generally conjectured that they have a language of some kind or other: but our knowledge of their usual habits, from their residing in a different element from our own, is so imperfect, that we have no positive data to build upon.

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* See White's Hist. of Selborne, vol. ii. p. 17.

† See Phil. Mag. No. 223, Nov. 1816, p. 392.

It is a curious fact, that many animals which are naturally dumb in the widest sense of the word, are possest of a power of producing sounds by the use of some external organ or foreign instrument, that forms a very convenient substitute for a natural tongue. I have formerly had occasion to observe this of the goat-chaffer or cerambyx, which, whenever taken, utters a shrill shriek of fright, by rubbing its chest against its wing-shells, and the upper part of its abdomen; and of the ptinus *fastidicus*, or death-watch, that produces its measured, and to the superstitious, alarming strokes, by striking its horny frontlet against the bed-post, or any other hard substance in which it takes its stand. The termes ***Pulsatorium***, or tick-watch, is an insect of a different order; but armed with a similar apparatus, and makes a noise by the same means, like the ticking of a watch, from the old wood or decayed furniture in which it loves to reside, and by which it endeavours to entice the other sex to its company. And it is a singular circumstance, which I shall merely glance at in passing, that some species of the woodpecker, in the breeding season, in consequence of the feebleness of its natural voice, makes use of a similar kind of call by strong reiterated strokes of the bill against a dead sonorous branch of a tree.

The most astonishing instance, however, of sound excited in this manner, is that made by two species of Italian grasshoppers; the cicada ***Plebeja***, and c. *orni*. The music of these insects (which is confined to the male) is produced by a very singular apparatus, that consists of several winding cells under the abdomen, separated by different membranes, and opening externally by two narrow valves. In the centre of these cells is contained a scaly sonorous triangle, and exterior to them are two vigorous muscles, by the action of which the cells are supplied with air through one of the valves, and so powerfully reverberate it against the triangle as to produce the notes of which the grasshopper's song consists; and which is sometimes so loud that a single insect hung in a cage has almost drowned the voices of a large company. This song is also the madrigal of love.

But highly tempting as it is, I must not pursue this part of our subject any farther. From the birds of the field, to the grasshopper, from the bee to the fly, every attentive naturalist observes in every tribe, a vast compass of accentuation, and comprehends the meaning of a great variety of their tones. But what is the little that we understand to what is understood by themselves, formed with similar organs, in a thousand instances more acute than our own, actuated by similar wants, and proposing to themselves similar pursuits!

What the natural language of man is we know not. There can be no doubt, however, that if, by a miracle, he were to be deprived of all artificial language, there would still retain to him, from the perfection of his vocal organs, a language of this kind, and of far greater extent and variety than that of any other animal.

But some schools of philosophers have not been satisfied with contemplating such an idea hypothetically; they have boldly embodied it into a fact, and have contended, and still continue to contend, that such a language has actually existed; and that it constituted the sole language of man on his first formation: the only means he possest of communicating and interchanging his ideas.

But whence then has artificial language arisen? That rich variety of tongues that distinguishes the different nations on the earth; and that wonderful facility which is common to many of them of characterizing every distinct idea by a distinct term?

And here such philosophers are divided: some contending that speech is a science that was determined upon and inculcated in an early period of the world, by one, or at least a few superior persons acting in concert, and inducing the multitude around them to adopt their articulate and arbitrary sounds: while others affirm that it has grown progressively out of the natural language, as the increasing knowledge and increasing wants of mankind have demanded a more extensive vocabulary.*

Pythagoras first started the former of these two hypotheses, and it was afterwards adopted by Plato, and supported by all the rich treasure of his genius and learning; but it was ably opposed by the Epicureans, on the ground that it must have been equally impossible for any one person, or even for a synod of persons, to have invented the most difficult and abstruse of all human sciences, with the paucity of ideas, and the means of communicating ideas, which, under such circumstances, they must have possessed: and that even allowing they could have invented such a science, it must still have been utterly impossible for them to have taught it to the barbarians around them. The argument is thus forcibly urged by Lucretius, whom I must again beg leave to present in an English dress:—

> But to maintain that one devis'd alone
> Terms for all nature, and th' incipient tongue
> Taught to the gazers round him, is to rave.
> For how should he this latent power possess
> Of naming all things, and inventing speech,
> If never mortal felt the same besides?
> And, if none else had e'er adopted sounds,
> Whence sprang the knowledge of their use? or how
> Could the first linguist, to the crowds around
> Teach what he mean'd? his sole unaided arm
> Could ne'er o'erpower them, and compel to learn
> The vocal science; nor could aught avail
> Of eloquence or wisdom; nor with ease
> Would the vain babbler have been long allow'd
> To pour his noisy jargon o'er their ears.†

In opposition to this theory, therefore, Epicurus and his disciples contended, as I have just observed, that speech or articulate language is nothing more than a natural improvement upon the natural language of man, produced by its general use, and that general experience which gives improvement to every thing. And such still continues to be the popular theory of all those philosophers of the present day, who confine themselves with the mere facts and phenomena of nature, and allow no other authority to control the chain of their argument. Such, more especially, is the theory of Buffon, Linnéus, and Lord Monboddo; who, overstepping the limits of the Epicurean field of reasoning, and the articles of the Epicurean belief, concur, as I have already remarked, in deriving the race of man from the race of monkeys, and in exhibiting the orang-otang, as his dignified prototype and original, whom they have hence denominated the satyr or man of the woods.

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* See on this subject Harris's Hermes, book iii. p. 314. 327. and Beattie on the Theory of Language, p. 246. Lond. 1803. 4to.

† Proinde, putare aliquem tum nomina distribuisse
Rebus, et inde homines didicisse vocabula prima,
Desipere est: nam quur hic posset cuncta notare
Vocibus, et varios sonitus emittere linguæ,
Tempore eodem aliei facere id non quisse putentur?
Præterea, si non aliei quoque vocibus usei
Inter se fuerant, unde insita notities est?
Utilitas etiam, unde data est huic prima potestas,
Quid vellet facere, ut sciret, animoque videret?
Cogere item plureis unus, victosque domare,
Non poterat, rerum ut perdiscere nomina vellent:
Nec ratione docere ulla, suadereque surdis,
Quod sit opus facto; faciles neque enim paterentur:
Nec ratione ulla sibi ferrent amplius aureis
Vocis inauditos sonitus obtundere frustra.

De Rer. Nat. v. 1040.

I shall not exhaust the time or insult the understanding of this auditory by any detailed confutation of the new and adscititious matter contained in this modernized edition of the Epicurean theory; matter of which the Grecian sage himself would have been ashamed; and which is directly contradicted by the anatomical configuration of various and important parts of this animal itself; concerning which, it is scarcely necessary to recall to your recollection the remark we have just made—that whilst it approaches nearest to the form, it is farthest removed from the language of man of almost all quadrupeds whatever. I shall confine myself to the fair question, which the theory in its original shape involves;—is human speech, thus proved to be incapable of origin by any compact or settled system, more likely to have originated from a succession of accidents—from the casual but growing wants, or the casual but growing improvements of mankind?

Now admitting the affirmative of this question, we have a right to expect that the language of a people will always be found commensurate with their civilization: that it will hold an exact and equal pace with their degree of ignorance, as well as with their degree of improvement. It so happens, however, that although language, whatever be its origin, is the most difficult art or science in the world, (if an art or science at all) it is the art or science in which savages of all kinds exhibit more proficiency than in any other. No circumnavigator has ever found them deficient in this respect, even where they have been wofully deficient in every thing else; and while they have betrayed the grossest ignorance in regard to the simplest toys, baubles, and implements of European manufacture, there has been no difficulty, as soon as their language has been, I will not say acquired, but even dipped into, of explaining to them the different uses and intentions of these articles in their own terms.

Again: there is in all the languages of the earth a general unity of principle, which evidently bespeaks a general unity of origin; a family character and likeness which cannot possibly be the effect of accident. The common divisions and rules of one language are the common divisions and rules of the whole; and, hence, every national grammar is, in a certain sense, and to a certain extent, an universal grammar; and the man who has learnt one foreign tongue, has imperceptibly made some progress towards a knowledge of other tongues. In all countries, and in all languages, there is only one and the same set of articulations, or at least the differences are so few, that they can scarcely interfere with the generality of the assertion: for diversities of language consist not in different sets of articulations, but only in a difference of their combinations and applications. No people have ever been found so barbarous as to be without articulate sounds, and no people so refined and fastidious as to have a desire of adding to the common stock.

But, independently of an uniform circle of articulations, and an uniform system of grammar, there is also an uniform use of the very same terms, in a great variety of languages, to express the very same ideas; which, as it appears to me, cannot possibly be accounted for, except upon the principle of one common origin and mother tongue; and I now allude more particularly to those kinds of terms, which, under every change of time, and every variety of climate, or of moral or political fortune, might be most readily expected to maintain an immutability; as those for example of family relationship and patriarchal respect; or descriptive of such other ideas as cannot but have occurred to the mind very generally, as those of earth, sky, death, deity. I shall beg leave to detain you while I offer a few examples.

In our own language we have two common etymons, or generic terms, by which to describe the paternal character, *papa* and *father;* both are as common to the Greek tongue as to our own, under the forms of παππας and πατηρ, and have probably alike issued from the Hebrew source אב or אבא pl. אבת. And I may fearlessly venture to affirm that there is scarcely a language or dialect in the world, polished or barbarous, continental or insular, employed by blacks or whites, in which the same idea is not expressed by the radical of the one or the other of these terms; both of which have been employed from the beginning of time in the same quarter of the globe, and naturally direct us to one common spot where man must first have existed, and whence alone he could have branched out. The term *father* is still to be found in the Sanscrit, and has descended to ourselves, as well as to almost every other nation in Europe, through the medium of the Greek, Gothic and Latin. Papa is still more obviously a genuine Hebrew term; and while it maintains a range almost as extensive as the former throughout Europe, it has an incalculably wider spread over Asia, Africa, and the most barbarous islands of the Pacific, and extends from Egypt to Guinea, and from Bengal to Sumatra and New Zealand. The etymons for *son* are somewhat more numerous than those for *father*, but the one or the other of them may be traced almost as extensively, as may the words *brother*, *sister*, and even *daughter;* which last branching out like the term *father*, from the Sanscrit, extends northward as far as Scandinavia.

The generic terms for the Deity are chiefly the three following, *Al* or *Allah*, *Theus* or *Deus*, and *God.* The first is Hebrew, the second Sanscrit, the third Persian, and was probably Palavi or ancient Persian. And besides these, there is scarcely a term of any kind by which the Deity is designated in any part of the world, whether among civilized or savage man. And yet these also proceed from the same common quarter of the globe, and distinctly point out to us the same original cradle for the human race as the preceding terms. Among the barbarians of the Philippine Islands the word is *Allatallah*, obviously "the God of Gods," or Supreme God; and it is the very same term, with the very same duplicate, in Sumatra. In the former islands, I will just observe also, as we proceed, that we meet with the terms, *malahet*, for a *spirit*, which is both direct Hebrew and Arabic; *is* and *dua*, *one*, *two*, which are Sanscrit and Greek; *tambor*, a *drum*, which is also Sanscrit; and *inferno*, *hell*, a Latin compound, of Pelasgic or other oriental origin. In the Friendly and other clusters of the Polynesian Islands, the term for God is *Tooa*, and in New Guinea, or Papuan, *Dewa*, both obviously from the Sanscrit; whence *Eatooaa*, among the former, is God the Spirit, or the Divine Spirit; *Ea*, meaning a spirit in these islands. And having thus appropriated the Sanscrit radical to signify the Deity, they apply the Hebrew *El*, as the Pelasgians and the Greeks did, to denote the *sun*, or the most glorious image of the Deity; whence *el-langee* means the *sky*, or sun's residence, and *papa ellangee*, or *papa langee*, fathers of the sky, or "*spirits*."

Allow me to offer you another instance or two. The more common etymon for *death*, among all nations, is *mor*, *mort*, or *mut;* sometimes the *r*, and sometimes the *t*, being dropped in the carelessness of speech. It is *mut* in Hebrew and Phœnician; it is *mor*, or *mort*, in Sanscrit, Persian, Greek, and Latin; it is the same in almost all the languages of Europe; and it was with no small astonishment the learned lately found out that it was the same also in Otaheite, and some other of the Polynesian islands, in which *mor-ai* is well known to signify a *sepulchre;* literally, the place or region of the dead; *ai* meaning a place or region in Otaheitan, precisely as it does in Greek. An elegant and expressive compound, and which is perhaps only to be equalled by the Hebrew *zalmut* (צל מות) literally, *death-shade*, but which is uniformly rendered, in the established copy of our Bibles, *shadow of death.*

Sir, in our own language, is the common title of respect; and the same term is employed in the same sense throughout every quarter of the globe. In Hebrew its radical import is "a ruler or governor;" *sir*, *s-her*, or *sher*, according as the *h* is suppressed, or slightly, or strongly aspirated; in Sanscrit and Persian it means the organ of the head itself; in Greek it is used in a sense somewhat more dignified, and is synonymous with *lord;* in Arabia, Turkey, and among the Peruvians in South America, it is employed as in the Greek; and not essentially different in Spain, Portugal, Italy, and France; the last country never using it, however, but with a personal pronoun prefixed; and it is the very same term in Germany, Holland, and the contiguous countries; the *s* being dropped in consequence of the *h* being aspirated more harshly; whence the Hebrew *s-her* is converted into *her*, used also commonly, as the similar term is in France, with the prefix of a *personal pronoun.*

The radical idea of the word MAN is that of a *thinking* or *reasonable being*, in contradistinction to the whole range of the irrational creation, by which the thinking being is surrounded. And here again I may boldly assert, that while in the primary sense of the word we have the most positive proof of the quarter of the globe from which it issued, and where mankind must first have existed, and from which he must have branched out into every other quarter, there is not a language to be met with, ancient or modern, insular or continental, civilized or savage, in use among blacks or whites, in which the same term, under some modification or other, is not to be traced, and in which it does not present the same general idea.

MAN, in Hebrew, to which the term is possibly indebted for its earliest origin, occurs under the form מבח (*maneh*), a verb directly importing "to discern or discriminate;" and which, hence, signifies as a noun, "a discerning or discriminating being." In Sanscrit we have both these senses in the directest manner possible; for in this very ancient tongue *man* is the verb, and can only be rendered "to think or reason;" while the substantive is *mana*, of precisely the same meaning as our own word *man:* and necessarily importing, as I have already observed, "a thinking or reasonable creature." Hence *Menu*, in both Sanscrit and ancient Egyptian, is synonymous with Adam, or the FIRST MAN, emphatically *the man;* hence, again, MENES was the first king of Egypt; and MINOS, the first or chief judge, discerner, or arbitrator among the Greeks. Hence, also, in Greek, *men* and *menos* (μεν and μενος) signify *mind*. or, "the thinking faculty;"

but μενος, contracted, is *mens*, which, in the Latin language, imports the very same thing. In the Gothic, and all the northern dialects of Europe, *man* imports the very same idea as in our own tongue; the English, indeed, having descended from the same quarter. In Bengalee and Hindoostanee, it is *manshu;* in Malayan, *manizu;* in Japanese, *manio*; in Atooi, and the Sandwich islands generally, *tane*, *tanato*, or *tangi;* while *manawe* imports the *mind* or *spirit;* and in New Guinea, or Papuan, it is *sonaman*, a compound evidently produced from *man*. In this utmost extremity, this *Ultima Thule* of the southern world, I will just observe also, in passing, that we meet with the terms *Sytan* for *Satan*, or the Source of Evil; and *Wāth* (Germ. *Goth*), for *God*.

But it may, perhaps, be observed, that in all the southern dialects of Europe, the French, Italian, Spanish, and Portuguese, we meet with no such term as *man;* nor in the Latin, from which all these are derived, in which last language the term for *man* is *homo*. Yet nothing is easier than to prove, that even *homo* itself, the source of all these secondary terms, is derived from the same common root. This is clear from its adjective, which is *hu-man-us:* while every schoolboy knows that *man*, or *men*, though not in the classical nominative case of the substantive, is included in every inflection below the nominative case: as ho-*min*-is, ho-*min*-i, ho-*min*-em, ho-*min*-e; and it was formerly included in the nominative itself, which was ho-*men;* whence, nothing is clearer than that the particle *ho* is redundant, and did not originally belong to the word. And were any additional argument necessary, I might advert to the well-known fact, that this redundant particle is absolutely omitted in the negation of *homo*, which is not *ne-homo*, but *nemo*, and was at first *ne-men;* and which, like *homo*, or *homen*, runs, as every one knows, ne-*mim*-is, ne-*min*-i, &c. It is easy, however, to prove this redundancy of the *ho*, by showing the quarter from which it was derived. The old Latin term was *ho-min*, *ho-min-is;* which every one must perceive is literally the obsolete Greek μεν, with the article ὁ added to it; ὁ μεν or *ho-men*, emphatically *the man*. The *ho* is also omitted in the feminine of *homo*, which is *fe-min-a*, and was at first *feo-min-a*, from *feo*, to produce; literally, the producer or bringer forth of man, or *min*. Nothing, as it appears to me, is clearer than this, though the etymologists have hitherto sought in vain for the origin of *femina*. From *feomina*, or, without the termination, *feomin*, we have derived our own and the common Saxon term, *woman;* the *f*, and *v* or *w*, being cognate, or convertible letters in all languages; of which we have a familiar instance in the words *vater*, and *father*, which in German and English, mean precisely the same thing.

But this subject would require a large volume instead of occupying the close of a single lecture. It is, however, as you will find, when we come to apply it, of great importance; and I must yet therefore trouble you with another example or two.

Youth and *young* are as capable of as extensive a research, and are as common to all languages, barbarous and civilized, as the word *man*. I will only at present remark that we meet with it in Hebrew, where it is יונה (*yuna*); in Persia and Palavi, or ancient Persian, where it is *juani;* in Sanscrit, where it is *yauvan;* in Greek, υἱον (*yion*), from υἱος or υἱωνος; in Latin, where we find it *juvenis;* in Gothic and German, where it is *jung;* in Spanish, *joven;* in Italian, *giovan;* in French, *jeune;* and, as I have already observed, in our own dialect, *young*.

The word *regent*, in like manner is, and ever has been, in equal use among all nations. This, like the French *regir*, is derived from the Latin *rege;* which runs through all the southern dialects of Europe; while in Germany, and the north, the derivative *recht* is the common term for *rule, law, authority.* The Hebrew is ראי (*raj*), a conspicuous or illustrious person; the Sanscrit, *raja;* the Greek, *ρα* and *ραων;* of the same exact import as the Hebrew; and hence *ra*, or *raia*, imports *the sun*, the most powerful and illustrious object in creation, among a multitude of barbarous nations, and especially those of the Sandwich Islands, and New Zealand; and *ooraye* and *rayan-ai* the *day* or *light* itself, in different parts of Sumatra. Our own term *ray*, common indeed to almost all Europe, ancient and modern, is obviously from the same source; and hence the Arabic (*rayhe*), *fragrancy*, *odour;* the poetic mind of the Arabians uniformly applying this image to legitimate rule and government.

The term *name*, in like manner, runs through all the leading languages of ancient and modern ages, almost without a shade of difference, either in its meaning or mode of spelling: for we thus meet with it in Hebrew, Sanscrit, Arabic, Greek, Persian, Gothic, and Latin.

The same theory might be exemplified from many of the terms significative of the most common animals. Our English word *cow* is of this description, and may serve as a familiar example; גוה (*gouah*,) in Hebrew, imports *a herd* (as of oxen); the very same word in Greek, *γυα*, means a yoke of oxen; in both which cases the word is used in a collective sense. In Sanscrit, *gāva* imports, as among ourselves, a single animal of the kind, *ox* or *cow;* in Persian, and ancient Persian or Palavi, it is *gow;* in German, *kuh;* and among the Hottentots, as an example of a savage tongue, *koos* and *koose;* while among the New Zealanders, who have no cows, *eu* imports paps or breasts, the organ of milk.

Mouse is in like manner משה (*musheh*) in Hebrew, literally "a groper in the dark:" in Sanscrit, *mushica;* in Persian and Palavi, *mush;* in Greek, *μυς*, without the aspirate; in German, *mous;* in English, *mouse;* in Spanish, *musgano;* all, as I have already observed, confederating in proof that the various languages, and dialects of languages, that now are or ever have been spoken, have originated from one common source; and that the various nations that now exist or ever have existed have originated from one common cradle or quarter of the world, and that quarter an eastern region.

Finally, and before I close this argument, and deduce from its fair and legitimate result, let me pointedly call your attention to that most extraordinary act of correspondence between all nations whatever, in all quarters of the globe, wherever any trace of the art exists, which is to be found in their employment of a decimal gradation of arithmetic; an argument which, though I do not know that it has ever been advanced before, is, I freely confess to you, omnipotent of itself to my own mind. Let me, however, repeat the limitation, *wherever any trace of this art is found to exist;* for in the miserable state to which some savage tribes are reduced, without property to value, treasures to count over, or a multiplicity of ideas to enumerate; where the desires are few and sordid, and the fragments of language that remain are limited to the narrow train of every-day ideas and occurrences, it is possible that there may be some hordes who have lost the art entirely; as we are told by Crantz is the case with the wretched natives of Greenland,* and by the Abbé Chappé with some families among the Kamschatkadales ;* while there are other barbarian tribes, and especially among those of America,† who cannot mount higher in the scale of enumeration than five, ten, or a hundred ; and, for all beyond this, point to the hair of their head, as a sign that the sum is innumerable.

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* Sect. i. 225.

But, putting by these abject and degenerated specimens of our own species who have lost the general knowledge of their forefathers, whence comes it to pass, that blacks and whites in every other quarter, the savage and the civilized, wherever a human community has been found, have never either stopped short of nor exceeded a series of ten in their numerical calculations ; and that as soon as they have reached this number, they have uniformly commenced a second series with the first unit in the scale, one-ten, two-ten, three-ten, four-ten, till they have reached the end of the second series ; and have then commenced a third, with the next unit in rotation : and so on, as far as they have had occasion to compute ? Why have not some nations broken off at the number five, and others proceeded to fifteen before they have commenced a second series ? Or why have the generality of them had any thing more than one single and infinitesimal series, and consequently a new name and a new number for every ascending unit ? Such an universality cannot possibly have resulted except from a like universality of cause ; and we have, in this single instance alone, a proof equal to mathematical demonstration, that the different languages into which it enters, and of which it forms so prominent a feature, must assuredly have originated, not from accident, at different times and in different places, but from direct determination and design, at the same time and in the same place ; that it must be the result of one grand, comprehensive, and original system. We have already proved, however, that such system could not be of human invention ; and what then remains for us but to confess peremptorily, and *ex necessitate rei*, as the fair conclusion of the general argument, that it must have been of divine and supernatural communication ?

It may be observed, I well know, and I am prepared to admit the fact, that the examples of verbal concordance in languages radically distinct, and not mere dialects of the same language, are, after all, but few, and do not occur, perhaps, once in five hundred instances.‡ But I still contend the examples, few as they are, are abundant and even super-abundant to establish the conclusion ; and the fact on which the objection is founded, instead of disturbing such conclusion, only leads us to, and completely establishes a second and catenating fact ; namely, that by some means or other the primary and original language of man, that divinely and supernaturally communicated to him in the first age of the world, has been broken up and confounded, and scattered in various fragments over every part of the globe : that the same sort of disruption which has rent asunder the solid ball of the earth ; that has swept away whole species and kinds, and perhaps orders of animals, and vegetables, and minerals, and given us new species, and kinds, and orders in their stead ; that has confounded continents and oceans, the surface and the abyss, and intermingled the natural productions of the different hemispheres ; that the same sort of disruption has assaulted the world's primeval tongue, has for ever overwhelmed a great part of it, wrecked the remainder on distant and opposite shores, and turned up new materials out of the general chaos. And if it were possible for us to meet with an ancient historical record, which professed to contain a plain and simple statement of such supernatural communication, and such subsequent confusion of tongues, it would be a book that, independently of any other information, would be amply entitled to our attention, for it would bear an index of commanding authority on its own forehead.

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* Sect. iii. 17.

† Robertson, vol. ii. b. iv. 91.

‡ Compare also with Stewart's Phil. Essays, vol. i. p. 150. 4to. Edin. 1810.

To pursue this argument would be to weaken it. Such a book is in our hands—let us prize it. It must be the word of God, for it has the direct stamp and testimony of his works.

LECTURE X.

ON LEGIBLE LANGUAGE, IMITATIVE AND SYMBOLICAL.

The subject of the vocal organs, and the scales of tones and terms to which they give rise, which have just passed under review, led us progressively into an inquiry concerning the nature of the voice itself; and the origin of systematic or articulate language.

Systematic or articulate language, however, as we have already observed, is of two kinds, *oral* and *legible;* the one spoken, and addressed to the ear, the other penned or printed, and addressed to the eye. It is this last which constitutes the wonderful and important art of writing, and distinguishes civilized man from savage man, as the first distinguishes man in general from the brute creation. The connexion between the two is so close, that although both subjects might, with the most perfect order, find a place in some subsequent part of that comprehensive course of study upon which we have even now but barely entered, I shall immediately follow up the latter for the very reason that I have already touched upon the former. It will, moreover, if I mistake not, afford an agreeable variety to our philosophical pursuits; a point, which ought no more to be lost sight of in the midst of instruction than in the midst of amusement; and will form an extensive subject for useful reflection when the present series of our labours shall have reached its close.

Written language is of so high an antiquity, that, like the language of the voice, it has been supposed, by a multitude of wise and good men in all ages, to have been a supernatural gift, communicated either at the creation, or upon some special occasion not long afterwards. Yet there seems no satisfactory ground for either of these opinions. That it was not communicated like oral language at the creation of mankind, appears highly probable, because, first, it by no means possesses the universality which, under such circumstances, we should have reason to expect, and which oral language displays. No tribe or people have ever been found without a tongue; but multitudes without legible characters. Secondly, among the different tribes and nations that do possess it, it is far from evincing that unity or similarity in the structure of its elements which, I have already observed, is to be traced in the elements of speech, and which must be the natural result of an origin from one common source. The system of writing among some nations consists in pictures, or marks representative of things; among others in letters or marks symbolical of sounds; while, not unfrequently, the two systems are found in a state of combination, and the characters are partly imitative and partly arbitrary. And thirdly, there does not seem to be the same necessity for a divine interposition in the formation of written characters as in that of oral language. The latter existing, the former might be expected to follow naturally in some shape or other, from that imitative and inventive genius which belongs to the nature of man, and especially in a civilized state. And, as we endeavour to penetrate the obscurity of past ages, we meet with a few occasional beacons which point out to us something of the means by which this wonderful art appears to have been first devised, and something of the countries where it appears to have been first practised.

But an exception is made by many learned and excellent men in favour of one species of writing: namely, that of alphabetic characters, which is conceived to be so far superior to every other method, as to have demanded and justified a special interposition of the Deity at some period of the creation; and, by turning to the Pentateuch, a few texts, we are told, are to be met with, which seem to intimate that the knowledge of letters was first communicated to Moses by God himself, and that the Decalogue was the earliest specimen of alphabetic writing.

Such was the opinion of many of the fathers of the Christian church, and such continues to be the opinion of many able scholars of modern times: as, among the former, St. Cyril, Clement of Alexandria, Eusebius, Isidore; and, among the latter, Mr. Bryant, Mr. Costard, Mr. Windar.* And it is hence necessary to remark in addition to what has already been observed, that, so far from arrogating any such invention or communication to himself, Moses uniformly refers to writing, and even to alphabetic writing, as an art as common and as well known in his own day as at present. He expressly appeals to the existence of written records, such as tablets or volumes, and to the more durable art of engraving, as applied to alphabetic characters. Thus, in the passage in which writing is first mentioned in the Scriptures, "And the Lord said unto Moses, *write* this for a memorial in a *book* or *table*."† And shortly afterwards, "And thou shalt make a *plate* of pure gold, and *grave* upon it like the engravings of a signet, HOLINESS TO THE LORD."‡ The public seals or signets of oriental princes are well known to be of the same description even in the present day, and, to be ornamented with sentences, instead of with figures or mere ciphers. In the State Paper office, at Whitehall, there are still to be seen a number of letters from eastern monarchs to the kings of England, with seals of this very kind, the inscriptions of several of which are copied by Mr. Astle into his valuable work upon the present subject.§

In that sublime and unrivalled poem, the book of Job, which carries intrinsic, and in the present individual's judgment, incontrovertible evidence of its being the work of Moses, we meet with a similar proof of the existence and general cultivation of both these arts, at the period before us; for, it is thus the afflicted patriarch exclaims under a dignified consciousness of his innocence:

> O! that my words were even now written down:
> O! that they were engraven on a table:
> With a pen of iron upon lead:—
> That they were sculptured in a rock for ever!‖

Nor do the Hebrews alone appear to have been possessed of written characters at this era. Admitting Moses to be the author of this very ancient poem, we find him ascribing a familiar knowledge of writing, and not only of writing but of engraving and sculpture, to the Arabians; for of this country were Job and his companions. And if, as appears from the preceding passages, the Hebrews were generally acquainted with at least two of these arts at the time of their quitting Egypt, it would be reasonable to suppose, even though we had no other ground for such a supposition, that the Egyptians themselves were equally acquainted with them.

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* Compare Astle's Origin of Writing, &c. p. 11. 4to.

† Exod. xvii. 14.

‡ Id. xxviii. 36.

§ Origin and Progress of Writing, p. 14. 4to. 1803.

‖ Job, xix. 23, 24.

We have also some reason for believing that alphabetic writing was at this very period common to India; and either picture-writing or emblematic writing to China. The Hindu Scriptures, if the term may be allowed, consist of four distinct books, called Baids or Beids, Bedas or Vedas, which are conceived to have issued successively from each of the four mouths of Brahma; and of these, Sir William Jones calculates that the second or Yajur Beda may have been in existence fifteen hundred and eighty years before the birth of our Saviour, and consequently in the century before the birth of Moses: whence, if there be any approach towards correctness in the calculation, the first or Rik Beda must, at the same epoch, have been of very considerable standing. He dates the institutes of Menu, the son or grandson of Brahma, which he has so admirably translated, at not more than two centuries after the time of Moses; though he admits that these are the highest periods that can fairly be ascribed to both publications:* and is ready to allow that they did not at first exist in their present form, and were, perhaps, for a long time only traditionary. It is impossible not to wish that the facts upon which this extraordinary scholar builds his premises were established with more certainty, and that the conclusions he deduces from them were supported by inferences and arguments less nicely spun. Admitting the existence of these compositions in any sort of regular shape on their first appearance, it seems more reasonable to suppose, considering their complicated nature and extent, that they were handed down from age to age in a written form, than that they maintained a precarious life by mere oral tradition; for, if the Egyptians, as appears almost unquestionable, were in possession of legible characters at or before the time of Moses, there seems no solid ground for believing that the Hindus might not have been in possession of a similar art. The different ages of the *Kings*, or five sacred and most ancient books of the Chinese, have been still less satisfactorily settled than the Vedas of the Hindus. A very high antiquity, however, is fully established for them by a distinct reference to their existence in the Institutes of Menu; nor perhaps less so in the very simple and antiquated style in which all of them are written, how much soever the characters of any one of these books may differ from any other: and, adopting the chronology of the Septuagint, Mr. Butler ingeniously conjectures that the era of the Chinese empire may be fixed, with some latitude of calculation, at two thousand five hundred years before Christ,† which would make it nearly a thousand years before the birth of Moses.

"The annals of China," says Dr. Marshman, "taken in their utmost extent, synchronize with the chronology of Josephus, the Samaritan Pentateuch, and the Septuagint, rather than with that contained in our present copies of the Hebrew text; and, according to the former, the highest pretensions of their own annals leave the Chinese *inhabiting the woods, and totally ignorant of agriculture*, nearly five hundred years after the deluge."* The Y-King, or oldest of their sacred books, consists of horizontal lines, entire or cut, which are multiplied and combined into sixty-four different forms or positions. They appear involved in almost impenetrable mystery, as well as antiquity; but, so far as they have been deciphered, they seem, in conjunction with the other sacred books, to contain a summary of patriarchal religion, or that which alone ought to be regarded as the established religion of China; under which the people are taught to know and reverence the Supreme Being, and to contemplate the emperor as both king and pontiff; to whom, exclusively, it belongs to prescribe ceremonies, to decide on doctrines, and, at certain times of the year, to offer sacrifices for the nation.†

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* He calculates the first three Vedas to have been composed about 300 years before the Institutes, and about 600 before the Puranas and Itahasas, which he felt convinced were not the production of Vyasa. Works, vol. ii. p. 305; and iii. p. 484. 4to. ed.

† Horæ Biblicæ, vol. ii. p. 179. 2d ed. 8vo. 1807.

It becomes me, however, to observe that, with all the researches of our most learned writers, we are still involved in a considerable degree of uncertainty concerning the chronology of several of the Oriental empires, and still more so concerning their most ancient publications. M. Freret and M. Bailly, generally speaking, concur in the periods assigned to the earliest Oriental writings by Sir William Jones; but the pretension of several of them, and especially of the Puranas, or series of mythological histories, to a very high antiquity, has lately been powerfully attacked by Mr. Bentley, in his dissertation on the Suryá Siddhanta;‡ and still later by Captain Wilford, in his series of Essays on the Sacred Isles of the West;§ and a fall in the pretensions of these may probably be succeeded by a like fall in those of various others.‖

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* Elements of Chinese Grammar; with a Preliminary Dissertation on the Characters and Colloquial Medium of the Chinese. Serampore. 4to. 1814.

† Lettres Edif. et Cur. tom. xxi. p. 218. 1781.

‡ Butler, p. ii. ut supr. p. 175. Asiatic Researches, vol. vi.

§ Asiatic Researches, vol x. See also Edin. Rev. No. xxxii. p. 387—389. The difference is indeed wonderful; for while Sir William Jones reckons the Puranas at nearly 2500 or 2600 years old, "it is evident," says Mr. Bentley, "that none of the modern romances commonly called the Puranas, at least in the form in which they now stand, are older than 484; and that some of them are compilations of still later times."—Asiatic Researches, vol. viii. p. 240. And to nearly as late a date are they assigned by Mr. Wilford; "They are certainly," says he, "a *modern* compilation from valuable materials, that, I am afraid, no longer exist. An astronomical observation of the heliacal rising of Canopus mentioned in two of the Puranas puts this beyond doubt." Id. vol. p. 244. Mr. Coleman is of this same opinion; at least in respect to one of them, the Sri Bhagaveta; which, he further tells us, is considered even by many of the learned Hindus as the work of a grammarian supposed to have lived about 600 years ago. Id. vol. viii. p. 487.

‖ There is a doubt which has the best claim to the highest antiquity, the religion of Boodh or that of Brahma. One of the most authentic accounts we have of the former is that transmitted to the American Board of Missions by Mr. Judson, a man of great excellence and intelligence, who has resided in the Burman empire as a missionary, at Rangoon or at Ava, from 1814, to, I believe, the present time; to which I shall also have occasion to advert hereafter. Mr. Judson is intimately acquainted with the language, the customs, and established creed of the Burman empire; and, according to his account, the priests of Boodhism, though they claim for themselves a higher origin than those of Brahma, make no pretence to an extravagant antiquity. "Boodh," says Mr. Judson, "whose proper name is Gaudama, appeared in Hindoostan about TWO THOUSAND THREE HUNDRED YEARS AGO, and gave a new form and dress to the old transmigration system, which, in some shape or other, has existed from time immemorial. The Brahmans, *in the mean time*, dressed up the system after their fashion; and both these modifications struggled for the ascendancy. At length the family of Gaudama, which had held the sovereignty of India, was dethroned, his religion was denounced, and his disciples took refuge in Ceylon, and the neighbouring countries. In that island, about 500 years after the decease and supposed ANNIHILATION OF THEIR TEACHER OR DEITY, they composed their sacred writings in the Sanscrit which had obtained in Ceylon; whence they were conveyed by sea to the Indo-Chinese nations (those of the Burman empire.) Boodhism, however, had gained a footing in Burmah before the arrival of the sacred books from Ceylon. It is commonly maintained that it was introduced by his emissaries before his *death*." *Correspondence*, 1819.

Even China, at the time of Moses, according to the statement of their own writers, had not long emerged from a state of the grossest barbarism. It is admitted in the Lee K'hee, that, during the reigns of Yaou and Shun, or about two thousand years before Christ, the people, as we have just observed, were living in a savage state, in woods and caves, and holes dug in the ground; covering themselves with the skins of beasts, and rude garments formed of the leaves of trees, grass, reeds, and feathers. Even one thousand years later, or during the dynasty Chow, their states or clans amounted to not less than eighteen hundred, each of which had its chieftain, who possessed absolute and hereditary power; though all united in acknowledging the supremacy of this family and conceding to it the imperial dignity. It was only about two hundred years before our own era that these clans were reduced to seven; and some time afterwards that Che-hwang-he, the first emperor of the dynasty T'sin, succeeded in almalgamating the whole into one vast and massy despotism, the great outlines of which continue to the present day.* Yet, as far down as nine hundred and eighteen years before Christ, or about five hundred years before the era of Confucius, notwithstanding their symbolical characters and sacred books, in use among the learned, Dr. Milne affirms, from their own historians, that generally speaking they were barbarians in literature as well as in manners, and could "neither read, nor write, nor cipher."† And I may here add, that whatever were their writings, and by whomsoever written, in earlier ages, the Chinese have, at this day, none of a higher date than those composed by Confucius himself, five hundred years before our own era, or compiled by him from rude and imperfect copies of more ancient productions, for the most part indented on plates or pieces of wood rather than transcribed on paper.

Upon the whole, however, the conclusion I have ventured to advance seems to be strengthened by the general tenor of the inquiry into this subject, and affords us additional ground for believing that the art of writing, even by the use of alphabetic characters, instead of having been communicated to Moses by some special interposition of the Deity, was, in his day, as familiar to his countrymen as to himself; that it was generally known throughout Egypt, and, perhaps, cultivated over various parts of Asia.

Contemplating written language, therefore, as of human invention, let us next inquire into the most probable means by which it was invented and brought to perfection; and the countries in which it originated.

Supposing,‡ by a miracle, the world were now to be reduced to the stage in which we may conceive it to have existed in its infancy; and every trace and idea of written language were to be swept away, and the only means of communication to be that of the voice, what would be the mode most likely to be resorted to of imparting to a deaf person, or a foreigner ignorant of our dialect, a knowledge of any particular fact or thing with which we might wish him to be acquainted? The reply is obvious: we should point at it if in sight; and if not, endeavour to sketch a rude drawing of it; and thus make one sense answer the purpose of another. This is not mere fancy but manifest and experimental fact; it is the plan actually pursued in most institutions for instructing the deafly-dumb, and the elementary system by which they acquire knowledge. In such establishments, however, it is the elementary system alone; for the use of letters significative of words or sounds is, in every respect, so far superior to that of pictures significative of things, that the latter is uniformly dropped as soon as ever it has answered its purpose and served as a key to the former.

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* Part iv. sec. 9. See Milne's Retrospect of the First Ten Years of the Protestant Mission to China. Malacca Press. 8vo. 1820. p. 18.

† Kwoh-tseh. Pref. p. 1. Milne, ut supr. p. 20.

‡ A few pages of this lecture, particularly adapted to the occasion, were introduced into an article in the British Review for 1811, at the request of the writer's friend, who was at that time its editor; and may be found in the analysis there given of Dr. Marshman's elements of Chinese Grammar.

But we are at present adverting to a state of things in which letters are supposed not to exist; and the only established mode of communicating between man and man is that of vocal language. Under such circumstances, the most natural method of conveying ideas to a person unacquainted with our tongue must be, as I have already observed, to point at the things to which they relate if at hand, as all savage nations are well known to do: and if not at hand, to trace out a rude sketch of them on the sand, the bark of a plant, or some other substance. In this manner the idea of a horse, a house, a dog, or a tree, may, as single objects, be as distinctly communicated as by alphabetic characters; while two or more houses may be made significative of a town, and two or more trees of a wood; and, by thus continuing to copy in successive series such things or objects of common notoriety as the train of our ideas might call for, a kind of connected narrative of passing events might be drawn up, which, though not calculated for minute accuracy, might be generally understood and interpreted.

This kind of language would be fairly entitled to the appellation of *picture-writing;* it would give the images of things instead of the symbols of sounds or words. In its scope, however, it must be extremely limited, for though conveniently adapted to express embodied forms, it must completely fail in delineating pure mental conceptions, abstract ideas, and such properties of body as are not submitted to the eye; as wisdom, power, benevolence, genius, length, breadth, hardness, softness, sound, taste, and smell.

Our next attempt, therefore, would be to remedy this deficiency: and the common consent of mankind in ascribing peculiar internal qualities and virtues to peculiar external forms, would enable us to lay hold of such forms to express the qualities and virtues themselves. Thus the figure of a circle might be made to signify a year; that of a hatchet, separation or division; that of an eye, watchfulness or providential care, if open; and sleep or forgetfulness, if closed; the figure of a harrow might represent a ploughed-field; and of a flag, a fortress; a rose-bud, odour; and a bale of goods, commerce.

Upon the same principle compound ideas might be expressed by a combination of characters; the character expressive of a man in the midst of that expressive of an enclosure, as a square, for example, might denote a prisoner; and an union of those significative of mouth and gold might import eloquence. And we hence advance to another kind of imitative characters, those of a mixt kind, and which are called ALLEGORICAL, or EMBLEMATIC WRITING.

It is obvious that legible language must be very considerably improved by such an accession of power; that it must become both more manageable and more comprehensive. It is obvious, also, that in a variety of abstract subjects, as those of philosophy or religion, the allegorical characters alone might be employed as a medium of communication; and that, by attaching an esoteric or concealed, instead of an exoteric or general, meaning to each, it would form a language of impenetrable privacy—a language from which every one would be shut out excepting those who might be in possession of its key.

The persons to whom we should chiefly look for learning and science in the state of the world to which I am at present adverting, would be the priesthood; or that elevated order which, among all uncultivated nations, concentrates in itself the three professions of law, medicine, and theology. It is among this order, therefore, that we should chiefly expect to meet with proofs of both these kinds of visible language; and hence, both kinds might also be fairly denominated HIEROGLYPHIC WRITING, or that of SACRED IMPRESSIONS. Thus, indeed, they have been denominated generally; the pure picture-writing being distinguished by the term curiologic hieroglyphs: and the allegorical, tropical or symbolical hieroglyphs.

Such kinds of picture-language, however, even with this improvement, must be attended with very considerable labour; and hence, from a desire to abbreviate that labour, we may readily conceive that the pictures or imitative characters would soon become simplified and contracted.

The idea of a MAN, formerly represented by his whole figure, might now be signified by his legs alone, as a simple acute angle, like a Greek Λ, which is the written character for a MAN in the Chinese tongue, the whole figure being supposed to have been employed at first; that of HAND, formerly represented by a perfect drawing of this organ, might be contracted into a Greek ψ, or rather the figure of Ψ, which is the old Chinese expression for this purpose, being a rude or rapid outline of the wrist, palm, and fingers; while the idea of UNION OR FRIENDSHIP, at first denoted by two such figures conjoined, as ΨΨ, might subsequently be abbreviated into Ѱ, which, in like manner, is the old Chinese written sign for both these ideas. Ingenuity, thus set to work, would soon be able to form a like device for the auxiliary parts of speech: concerning which it may be sufficient to observe that most of the prepositions might be expressed by some simple mark, whose precise meaning should be determined by its relative situation. Thus a plain horizontal stroke, as —, placed at the foot of a noun, might import UNDER it, and at its head ABOVE it; which is, in fact, the very device had recourse to in the old written language of China; so that the sign for MEASURE, with a horizontal line over it, imports ABOVE MEASURE; and below it, UNDER MEASURE; while, in the ordinary mark for HAND, as noticed above, the cross line is turned to the left to express LEFT-HAND, and to the right to express RIGHT-HAND, for both which, however, a somewhat different form is used in the present day.

In this manner picture-characters or images would insensibly become converted into arbitrary characters; which, to those acquainted with the meaning of the different marks, would answer the purpose as well, and would have an incalculable advantage in the facility of writing them.

We have now reached the utmost pitch of perfection which the legible language of *things* is, perhaps, capable of attaining. It has one superiority over that of *words*, or marks characteristic of *sounds;* namely that, when the pictures are drawn at full length, or, if abbreviated, where the key of the abbreviation is known, it is a species of writing addressed to all nations, and may be interpreted without a knowledge of their oral tongues. It speaks by painting, and appeals to what all are acquainted with. And hence M. Leibnitz, and many other philosophers, have conceived an idea that a system of pasigraphy or universal writing, a language of human thoughts, might be founded[*] upon some such invention.

It is easy to perceive, however, without any detail of facts, that such a system could never be carried into full effect among different nations; and that, plausible as it may appear at first sight, it must be loaded with inconveniences, and be equally defective and burdensome, even among people of the same empire. It is easy to conceive, to adopt the language of Sir George Staunton, as applied to the most perfect system of the kind that has ever been actually carried into execution, that it would consist of "a plan of which it may justly be said, that the practice is no less inconvenient and perplexing than the theory is beautiful and ingenious."[†] If a distinct character were to be employed to represent every distinct idea, the number of distinct characters would be almost incalculable: if a few distinct or simple characters only were to be made use of to represent such ideas as are most common, and the rest were to be expressed by combinations of these, though the number of distinct characters would be in some degree diminished, the memory would still have a difficult task to retain them; and the combinations would, in a thousand instances, be embarrassing and intricate.

Under this pressure of evils there can be no doubt that a contemplative mind, in whatever part of the world placed, would soon begin to reflect on the possibility of avoiding them, by making the contracted characters now in use, or any other set in their stead, significative of sounds or words rather than of things or images. By minute attention it would soon be discovered, that such an art, which would require, indeed, a general convention or agreement in order to its being generally embraced or understood, might be effected with less difficulty than would at first be imagined. It would be perceived that the distinct articulate sounds in any or in every language, as I had occasion to observe in our last lecture, are not many, and in every language are the same or nearly so: that in few languages they exceed twenty, and in none, perhaps, thirty;[‡] and that consequently from twenty to thirty arbitrary marks or alphabetical characters might be ample to express every simple sound, and, by their combinations, to denote every separate word or intermixture of sounds:[§] whence a written language might be formed, addressed to the ear instead of the eye, symbolical of oral language, and, of course, possessing the whole of its accuracy and precision; and as much more easy of attainment, as it would be more definite and comprehensive.*

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[*] See here also Northman's Panography, Repertory of Arts, ii. 307. iii. 91. Langlois's Pantograph, Mach. A. vii. 207. Lodwick's Universal Alphabet.

[†] Ta Tsing Leu Lee. Pref. p. xiv.

[‡] "Mr. Sheridan says the number of simple sounds in our tongue are twenty-eight. Dr. Kendrick says we have only eleven distinct species of articulate sounds; which, even by contraction, prolongation, and composition, are increased only to the number of sixteen; every syllable or articulate sound in our language being one of this number. Bishop Wilkins and Dr. William Holden, speak of about thirty-two or thirty-three distinct sounds."—Astle, p. 18.

[§] Tacquet asserts, that the various combinations of the twenty-four letters (without any repetition), will amount to 620,448,401,733,239,439,360,000.—Arithm. Theor. p. 517, ed. Amst. 1704. Clavius makes them only 5,852,616,738,497,664,000. In either case, however, it is evident "that twenty-four letters will admit of an infinity of combinations and arrangements sufficient to represent not only all the conceptions of the mind, but all words in all languages whatever." Astle, p. 20.—In like manner ten simple marks are found sufficient for all the purposes of universal calculations which extend to infinity: and seven notes, differently arranged, fill up the whole scale of music.

I have thus drawn a sketch of what there can be little doubt would be the case provided mankind were at this moment to be deprived by a miracle of all legible language, and reduced to the state in which we may conceive the world to have existed in its earliest ages. The art of writing would commence with imitative, and terminate in symbolical, characters; it would first describe by pictures or marks of things addressed to the eye, and after having passed through various stages of improvement would finish in letters, or marks of words addressed to the ear.

This is not a speculative representation; for I shall now proceed to show, as far as the period of time to which we are limited will allow me, that what we have thus supposed would take place, has actually taken place: that wherever alphabetic characters exist, or have existed, we have direct proofs, or strong reasons for believing, that they have been preceded by picture or imitative characters; and that wherever picture or imitative characters, the language of things, still continue to exist, instead of having been preceded by alphabetic characters, they have a strong tendency to run into them, and probably will run into them in the upshot. And in this view of the subject I am supported by many of the most celebrated philologists of the age, as Bishop Warburton, the President de Brosses, Mr. Astle, M. Fourmont, M. Gibelin.

The remains of Egyptian sculpture are but few; but they are sufficient to afford us specimens of each of the kinds of writing I have adverted to; the pure hieroglyph, or simple picture-style; the mixt, allegorical, or emblematic; the abbreviated or contracted; and the alphabetic; and the valuable relics which are to be seen in the British Museum, more especially the sarcophagi and the famous Rosetta stone, (as it is called,) erected in honour of Ptolemy V., contain examples of most of them. They prove to us also, the order of succession in which the changes were effected, and clearly indicate the pure picture-style to be the most ancient.

The magnificent ruins of Persepolis, the capital of ancient Persia, offer monuments to the same effect. The windows, the pillars, the pilasters, and the tombs, are loaded with characters of some kind or other, imitative, emblematical, or alphabetical. In many instances the pure picture-style is as correctly adhered to as in any Egyptian specimen; in others we meet with tablets filled with what may indeed be abbreviated emblems, but which appear to be letters, and which, at any rate, afford proof that the ancient Persians had, at this period, made some advance from characters for things towards characters for words.

The prophecy of the utter destruction of Babylon has been so completely fulfilled, that, although the banks of the Euphrates, on which this city stood, give evident proofs of magnificent ruins along their track, we cannot exactly ascertain its situation. On many of the bricks, however, which have been dug up from the midst of the general wreck, we find a peculiar sort of character, evincing an approach towards letters, and which are supposed to be abbreviated emblems, as emblems are often abbreviated pictures, employed by the Chaldean sages of Babylonia; who, according to Pliny, always engraved their astronomical observations on bricks.† And even in Southern Siberia, as high as the river Irbit, or Pishma, Strahlenberg asserts, that he found a variety of rude figures or emblems engraven on the rocks,* which seem to have preceded the use of the Tartar or Mantcheu alphabet.

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* De Brosses, sur l'Origin de l'Alphabet.

† Plin. vii. 56.

In America we meet with traces of picture-writing amidst the most savage tribes; every leader on returning from the field endeavouring to give some account of the order of his march, the number of his adherents, the enemy whom he attacked, and the scalps and captives he brought home, by scratching with coarse red paint a certain display of uncouth figures upon the bark of a tree, stripped off for this purpose. "To these simple annals, he trusts for renown, and soothes himself with a hope, that by their means he shall receive praise from the warriors of future times."† The Mexicans are well known to have acquired such a degree of perfection in this style of writing, that on the first arrival of the Spaniards on their coasts expresses were sent off to Montezuma, the reigning monarch, containing an exact statement of the fact, together with the number and size of the different ships, by a series of pictures alone, painted on the cloth of the country. It was thus this people kept their public records, histories, and calendars. We are still in possession of several very curious specimens of Mexican picture-writing, some of which exhibit several of the very emblems I have just adverted to, as those which would probably be had recourse to in our own day, were we miraculously to be deprived of all knowledge of alphabetic writing; as, a bale of goods to represent the idea of commerce, and a rose-tree that of odour. The most valuable specimens, however, of Mexican picture-writing, are those obtained by Mr. Purchas, and published in sixty-six plates, divided into three parts; the first containing a history of the Mexican empire under its ten monarchs; the second, a tribute-roll, representing what each conquered town paid into the royal treasury; and the third, a code of Mexican institutions, domestic, political, and military. Various other specimens are to be met with in different parts of Spain, and especially in the Royal Library at the Escurial; and a folio volume in the Imperial Library at Vienna. Along with the full pictures we occasionally meet, in some of these national archives, with emblems, or a prominent feature put for the whole figure; and in others with various symbols or arbitrary characters, making an approach towards letters; and thus confirming the progress from pictures to arbitrary signs which I have endeavoured to establish.

The written language of the Chinese, however, is carried to a still higher pitch of perfection; and is, perhaps, rendered as perfect as the system upon which it is founded will allow. It is still altogether a language of things, and was formerly very largely, if not altogether, a language of pictures. The pure picture-style is admitted by themselves to have been the oldest, or that first invented, and they expressly denominate this order of characters *siang* or *hing*, "form or image." "The picture," however, observes Dr. Morrison, "does not appear to have ever been intended as an exact representation, such as the picture-writing of Mexico, or the hieroglyphics of Egypt, but only a slight outline."‡ This kind of style is now become obsolete, and is rarely to be met with; but of the next series, or that into which the original or siang style was first transformed, which they call Yu-tsu, probably from the name of the great emperor Yu, or Chow, in whose era the transformation is said to have occurred, it is no uncommon thing to meet with specimens on rings, seals, and other public instruments.

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* De Vet. Lit. Hun. p. 15. Astle, p. 6.

† Robertson's America, vol. iii. b. vii. p. 303. Astle, p. 6.

‡ Chinese Miscellany.

These are strictly abbreviated pictures, such as symbols or emblems of some kind or other. But the characters now in use are abbreviations of these abbreviations; and hence have, for the most part, the appearance of being arbitrary marks, though we can still so frequently trace the parent image, as to decipher their origin and reference.

The Chinese is an extraordinary language in every respect. Its radical words do not exceed four hundred and eleven; every one of which is a monosyllable. But, as it must be obvious, that these can by no means answer the purpose of distinguishing every external object and mental idea, unless varied in some way or other, every one of these four hundred and eleven words is possessed of a number of different tones and combinations with other words; and every tone or combination signifies a different thing; so that the whole vocabulary, limited as it is, may be readily made to express several thousands of ideas. Thus the word *fu*, which enters into the well-known compound Kong-fu-tsee, or Confucius, pronounced in different manners, imports a *husband* or *father*, a *town*, and various other ideas. So *khoû*, imports a mouth; but pronounced nasally, as *khoong*, it denotes *empty;* and thus the word *shu*, differently uttered, means both a *lord* and a *swine.*

The whole of the elementary marks, or keys as they are called, by which the ideas of this language, for it is not the language itself, are written down and communicated, are still fewer than the elementary words; for they are only two hundred and fourteen, and express such ideas alone as are most common and familiar; as those of *plant*, *hand*, *mouth*, *word*, *sun*, *nothing*, *water;* every other idea being denoted by compounds, or supposed compounds of these elementary marks. Thus, the mark for a thicket, if doubled, implies a wood; and the union of the two characters of a man and a field signifies a farmer; the characters of a hand and a staff united, import parental authority, or a father; and it is from like characters I have selected the specimen of symbols which I have mostly submitted to you as some of those which would probably be invented in the present day, if, by a miracle, we were suddenly to be deprived of all knowledge of alphabetic writing.

By combinations of this kind, the two hundred and fourteen elementary characters, like the four hundred elementary words, are wonderfully increased, and are daily increasing; while the greater mass have so little resemblance to any one of the genuine elements, that the philologists of the present day regard many of them as primitive or independent signs, formed long subsequently to the invention of the proper elements, and combined, like themselves, in various ways.

I have said that the sum total of Chinese characters derived from these sources is perpetually increasing; and have also hinted, that from this natural tendency, the language must at length become an intolerable burden even to the most assiduous Chinese scholar. Thus, while all the characters that occur in Confucius, in Mung, and the five kings, or sacred books, forming together more than twenty volumes, fall considerably short of six thousand, including the numerous unusual words found in the four volumes of the Shu; (and I may add, that the scope is much the same in the celebrated ethical comment of Tung-tsee, the favourite disciple of Confucius, denominated Ta-hyoh, "the Great Sublime or Momentous Doctrine," as also in the Choong-yoong, Zun-zu, and Mun, constituting, conjointly, the four books most revered next to the Kings;)—such has been the accession of new terms invented by subsequent writers, and often with a forgetfulness of the old, which have hereby been suffered to become obsolete, that M. de Guignes was able, in his day, to collect and put into his dictionary eight thousand characters; the six national dictionaries that were chiefly in use about a century since, give from fifteen to about thirty thousand; and lastly, the Imperial Chinese Dictionary, composed by order of the Emperor Kang-khee, in 1710 of our own era, comprises not less than forty-three thousand four hundred and ninety-six characters!

Dr. Marshman, in his valuable "Elements of Chinese Grammar," observes that, in the Imperial Dictionary these stand arranged as follows:

Characters in the body of the work - - - - - - - -	31,214
Added, principally obsolete and incorrect forms of others	6,423
Characters not before classed in any dictionary - - -	1,659
Characters without name or meaning - - - - - - -	4,200
	43,496

We have here, therefore, a confession by the Chinese lexicographers themselves, that upwards of ten thousand of the characters admitted into the Imperial Dictionary, being nearly a fourth of the whole, are useless, and for the most part unintelligible, in the present day; independently of which, "a considerable number," observes Dr. Marshman, "of the 31,214 characters adopted from the former dictionaries have no meaning affixed to them; but are merely given as obsolete, or current but incorrect forms of other characters, to which the compilers of the dictionary have referred the reader for their meaning."* Whence we may fairly conclude that, of the characters which are still allowed to figure away in the written language of China, nearly half of the whole convey no ideas whatever, and are altogether representatives without constituents.

Were we able to follow even the latest of these up to their origin, and to prove that they have not issued, in the remotest manner, from the two hundred and fourteen elementary marks, which Dr. Marshman has endeavoured to do, we should probably still find them derived in the same manner from forms or symbols of things, and that they were at first direct imitations or conventional representatives; still, as I have already shown, united and compounded, or in some other way modified to express abstract or complicated ideas. It must be obvious, however, that characters thus constituted must be very loose and perplexing; and such, in fact, they are often found to be, by the most expert and best instructed natives. It must be obvious, at the same time, that a system of picture-writing, thus constructed and perfected, may, in a considerable degree, answer the purpose of alphabetic marks;† and it is doubtless owing alone to the perfection

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* Elements of Chinese Grammar, with a preliminary Dissertation on the Characters and Colloquial Medium of the Chinese, &c. By J. Marshman, D.D. Serampore, 1814. 4to.

† Among the numerous and important Library establishments of the present day, one has lately been opened by the co-operation of a committee of enlightened and public-spirited individuals, for a regular course of instruction by lectures in many of the most extensively spoken languages of the East, and, among the rest, in Chinese. The President is Lord Bexley: among the Vice-Presidents are Sir George Staunton, Bart., and Sir T. R. Raffles; its situation is in Bartlett's Buildings, Holborn; and while instruction in these valuable branches of literature is hereby offered to every one, it is *gratuitously* bestowed on all Christian Missionaries who are desirous of taking advantage of its benefits. It is, hence, emphatically denominated, a "LANGUAGE INSTITUTION IN AID OF THE PROPAGATION OF CHRISTIANITY," and few establishments of the present day are more entitled to the support of the nation, or of the world.

It should be further stated, moreover, in order to excite the fullest confidence of the public, which this system of writing had acquired in Mexico, and still exhibits in China, that the ingenious people of both countries stopped so long at the point of abbreviated emblems, significant of objects, and never fairly advanced from a legible language for things, to a legible language for words.

It should be observed, however, as a farther proof of the tendency of picture-characters to advance towards literal, that even in China itself the Mantcheu, or Tartars, have an alphabet, or system of verbal writing, and that the Mantcheu practice has long been acquiring a growing reputation. It should be observed, also, that the Chinese characters themselves have of late been resorted to at Canton, and by Chinese natives, as merely expressive of sounds, and been employed in the formation of an English vocabulary; in consequence, as Sir George Staunton remarks, of the great concourse of persons residing at this station who use the English language.* In like manner the Japanese, fond as they are of copying from the Chinese, have long since departed from their system of marks for things, and addicted themselves to alphabetic characters; sometimes writing them horizontally, and sometimes perpendicularly; both which methods are found in Chinese records, though the perpendicular is by far the most common.

Attempts have been made to prove that the picture-writing of the Egyptians, the Chinese, and the Mexicans, has proceeded from one common source; yet nothing can be more fanciful, and, apparently, nothing more

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that the professor in the Chinese department is the Rev. Dr. Morrison; while those in the Arabic, Persian, Bengalee, and Sanscrit are nearly of equal celebrity, and have the occasional assistance of Professor Lee, of Cambridge; and that all of them have entered into the undertaking with so much zeal and public spirit as to afford their valuable assistance gratuitously.

Nor has this instruction been offered in vain or unsuccessfully. Even in the Chinese department, where many might expect least to be accomplished, the very learned and excellent Professor, in his first Quarterly Report to the Committee, March 1, 1826, has stated, that he has been attended by thirteen students, seniors, and juniors, besides several ladies; with the progress of most of whom he has had great reason to be satisfied: and two or three of whom, having attained some previous knowledge of the language, are preparing to carry on the design after his own return to China.

The Institution is also under a deep and inexpressible obligation to Dr. Morrison, for the gratuitous use of his most valuable Chinese library,—by far the first in Europe,—and, perhaps, any where out of Asia; which is now deposited and arranged at the establishment. As a matter of high literary curiosity, I have requested its distinguished owner to furnish me with a brief account of the library for insertion in the present place, and my reverend friend has been kind enough to comply by the following communication, which I give in his own words:—

"In the LANGUAGE INSTITUTION there is deposited an extensive library of Chinese printed books and MSS., together with a museum intended to illustrate subjects referred to in the books. This Library and Museum are the property of Dr. Robert Morrison, the first Protestant missionary to China.

"There are between nine hundred and a thousand works; making in all about 10,000 volumes, stitched and bound in the Chinese manner.

"These books contain specimens of the literature of more than three thousand years; from the compilations and original writings of Confucius, five hundred years before the Christian era, down to the present time.

"The materials from which Confucius compiled the works he put forth, are not extant in any other form than that which he gave them: and, therefore, he may be regarded as the oldest Chinese writer whose works have come down to the present day.

"Dr. Morrison has not had time, during his sojourn in Europe, to make out a Catalogue Raisonne of his Chinese library, with a brief account of the chief works, titles, subjects, authors, date, &c.

"They consist of the sacred books of Chinese antiquity, with copious commentaries, written at various periods, and by a great variety of persons; history, ancient and modern; geography, and topography; astronomy; biography; opinions on government; rites and usages of China: religious books of *Laoukeunism; Budhism;* and the morals of *Confucianism;* poetry; historical and other novels: medicine; botany; and the materia medica; notices of foreign nations, and embassies to China; works composed by Jesuit missionaries concerning Europe and Christianity; the European geometry; and the astronomy of the fifteenth century, &c.; a few works on the religion of Mahomet, &c. &c.

* Embassy, ii. 576; Hagar's Chinese Elements, p. lxi.

unfounded; for each possesses a distinct style, derived from an attachment to distinct classes of images, for the most part of a local nature; as the sea-horse, the crocodile, the ibis, the ichneumon, the lotus, and papyrus, birds and other animals with human heads, and men with the heads of birds and dogs in the Egyptian system; the rabbit, cane, reed, flint, house, flag, and circle in the Mexican; and cross, parallel, crooked, and angular lines, as the abbreviated symbols of pictures, in the Chinese; derived, for the most part, as Dr. Morrison ingeniously conjectures, from the impressions of the feet of birds on the sand, and the lines on the bodies of shell-fishes.* Each has had a distinct origin, according as mankind in these different parts of the world, and under different circumstances, have found a necessity of recording facts and ideas in remote periods of antiquity; and each, as I have already observed, has an obvious tendency to run into arbitrary, and, ultimately, into alphabetical characters, though of different forms and descriptions.

Of all these, the system whose origin we are, perhaps, best capable of tracing historically, is the Phœnician; and here the voice of history completely coincides with the theory now advanced. The oldest Phœnician historian, whose writings have reached us in a few fragments and quotations, is Sanchoniatho, who was contemporary with Solomon, and drew up a history of Phœnicia, from existing monuments, and archives preserved in the college of the Phœnician priests. This history was dedicated to Abibalus, the Phœnician monarch, father of Hiram, king Solomon's ally; and was allowed by the king and the official censors appointed to examine it to be a work of great truth and accuracy. In this history Sanchoniatho places mankind, on their first creation, in Phœnicia; and gives us a genealogy of the patriarchs, from Adam, or Protogonus, as he calls him, to Taaut, Athoth, or Hermes, the successor of Menes, the first king of Egypt. In a passage of this very curious history, preserved by Eusebius, the author distinctly states, that picture-writing was invented by Ouranus, king of Phœnicia, who appears to have been contemporary with Misor or Misraim, the son of Ham; and that Taaut, the son of Misor, improved upon and abbreviated the picture-writing of Ouranus, either during the reign of Ouranus or of his son Cronus, or Saturn; and that Cronus having given Taaut the throne of Egypt, upon the death of Menes, the Egyptian monarch, the latter carried with him this improved picture or symbolical writing into that country. And in another passage he asserts that Taaut afterward carried forward this improvement to the invention of alphabetic characters. "Misor," says he, "was the son of Hamyn; the son of Misor was Taaut, who invented the first letters for writing. The Egyptians call him Thoth; the Alexandrians, Thoyth; and the Greeks, Hermes, or Mercury." He tells us, in a third place, that having thus invented letters, Taaut ordered the Cibiri and Dioscuri, the priests and sages of the country, to employ them in drawing up a history of Phœnicia.

This is a very curious and important relic of profane history; and it is interesting to observe its coincidence with the Mosaic narrative. It makes no mention, indeed, of the deluge, and it introduces two more generations in the line of Cain, from Protogonus, or *first-formed*, as the term literally implies (the Adam of Moses), to Agroverus, or Noah. It places, however, the first race of mankind in Phœnicia, which, in the latitude in which this term was generally understood, included, as I shall have occasion to show presently, the banks of the Euphrates, on which Moses fixes the garden of Eden; it allows nearly the same period of time between the creation and the era of Misor, or Misraim; and nearly the same number of generations as Moses does; and gives, as closely as may be, the same names to the son and grandson of Noah,—Ham and Misraim being merely transmuted into Ham-yn and Misor. There is coincidence enough in the two accounts to reflect authenticity upon each other: and had there been more, an advantage would eagerly have been taken of the Phœnician narrative, by skeptical polemics, and Moses would have been boldly accused of having stolen his history from this quarter.

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* Chinese Dictionary, p. 1.

This account of Sanchoniatho, moreover, is not only supported generally by the sacred records, but is distinctly corroborated in regard to the point immediately before us, that of the invention of letters, by the suffrages of Porphyry, Eusebius, Pliny, Quintus Curtius, Lucan, and, indeed, all the Latin writers. And although the Greeks entertained a somewhat different opinion, and ascribed the invention of letters to a younger Taaut, or Hermes, than the son of Misraim, and who flourished about four centuries afterward, and was born in Egypt, as the first Taaut was born in Phœnicia, nothing is more evident than that the Greeks were less acquainted with the history of both Egypt and Phœnicia than the Romans, in consequence of the greater range of the Roman power; and that they confounded two personages of the same name, and who possessed the same crown, and attributed to the one what ought to have been attributed to the other. The oldest Egyptian historian is Manetho, who probably drew up his dynasties about two centuries and a half before the Christian era; these only touch upon the subject indirectly, but, so far as they go, they rather support than oppose the testimony of Sanchoniatho.

There is some degree of doubt, whether Greece derived its letters from Egypt or from Phœnicia: the best authorities, however, incline to the last opinion; and suppose them to have been introduced by the Phœnician Pelasgi, upon their settlement in Peloponnesus. The oldest Greek letters are nearly Pelasgic in form; and, according to the usual fashion in the East, are written from right to left. This last, however, is by no means a decisive argument; for upon the earliest use of letters, in most countries, there seems to have been no settled rule: and hence, in, perhaps, all of them, we meet with letters running from right to left, and from left to right; in many very ancient specimens of Greek running alternately, the one line in one direction, and the ensuing in the other, like the course taken by a plough, whence it was denominated, from this machine, the ploughing style; and in both Persia and Egypt, running perpendicularly like the common style of the Chinese, instead of horizontally whether to the right or to the left.

That the Romans derived their alphabet from the Greeks is unquestionable: and hence, admitting the authority of Sanchoniatho, confirmed as it is by a variety of collateral evidences, the first invention of writing seems to rest with the Phœnicians, and we are able to trace it to within one hundred and sixty years of the flood.*

I am purposely, however, using the term Phœnician in a very extensive sense; in that sense in which it appears to have been used by Herodotus, and the generality of ancient writers, in consequence of Phœnicia being the earliest and most extensive commercial nation; as embracing not merely the maritime coast of Palestine, of which Tyre and Sidon were the chief cities, but the whole country of the Canaanites and the Hebrews, under whatever name it may have passed at different periods, and from different circumstances; as Syria, Assyria, Syrophœnicia, Sidonia, Aram; and, of course, as touching upon, or rather crossing Mesopotamia, Babylonia, and Chaldea. And I hence obtain an answer to those, on the one hand, who contend that alphabetic characters had their origin in Syria; and to those, on the other, who assert the same in respect to Chaldea, persuading themselves, upon a tradition current among the Jews and Arabians, that Abraham introduced them into Egypt on his migrating from Ur of the Chaldees, at the command of the Almighty, seven generations after the period we have just been contemplating. The fact is, that all these countries spoke the same language, or, at the utmost, dialects of the same language, that in no instance differed farther from each other than the Scottish differs from the English; and all used the same alphabet, or alphabets that possessed as little variation; and hence there can be no doubt, that, in whatever part of this quarter of the globe the system of alphabetic characters originated, they were readily and rapidly introduced into every other part. Abraham might, hence, have learnt them in Chaldea, or in Canaan, and communicated them wherever he sojourned; as Ishmael, probably, communicated them shortly afterward to Arabia, upon his exile from his father's house.

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* See Astle, pp. 45, 46. 64.

The proper Phœnician alphabet seems to have consisted of not more than thirteen letters at first; it afterwards had three added to it, making sixteen in the whole, and in this number it seems to have been earliest employed by many of the adjoining countries, and is distinguished by the name of the Samaritan, or ancient Hebrew, the terms and characters being nearly the same as the Phœnician. The Chaldeans introduced some kind of change into the form of the letters, made them more elegant, and added six other letters, since the Samaritan alphabet did not seem sufficiently full to express all the articulations of their speech. And in this manner, with various changes and augmentations, the Phœnician alphabet can be traced throughout every part of ancient and modern Europe; every region of Africa, where writing of any kind is current, and the western countries of Asia.

Over a very extensive portion of this last continent, however, we meet with an alphabet that has no common origin or conformity of principle with any hitherto described. This is the Nagari, or Deva-nagari, as it is called by way of pre-eminence. It consists of not less than fifty letters, of which sixteen are vowels and thirty-four consonants, all arranged in the order of the alphabet, with a systematic precision that is to be found nowhere else. The vowels take the lead, beginning with those most easily uttered, and terminating with those which approach towards a consonant sound. The consonants then follow in five regular series of gutturals, compounds, palatines, dentals, and labials: the whole closing with letters expressive of sounds that do not exactly enter into any of the preceding series, and which may be regarded as forming a general appendix. This alphabet is asserted by many learned Bramins to be of a higher antiquity than any other; and there can be no doubt that it has a just claim to a very remote date. But its very perfection is a sufficient confutation of its having been invented first of all: something far more rude and incondite must have preceded and paved the way for it; and in the complex characters of which it consists, we seem to have the relics of that emblematic or picture-language, which I have thus endeavoured to prove has laid a foundation for alphabetic writing in every part of the world. With a few trifling variations this correct and elegant alphabet extends from the Persian Gulf to China; but it has no pretensions to rival the antiquity of the Phœnician. It is unborrowed, but of later origin.

Such is a brief history of the noblest art that has ever been invented by the unassisted efforts of human understanding; an art that gives stability to thought, forms a cabinet for our ideas, and presents, in imperishable colours, a speaking portraiture of the soul. Without this, hard indeed would be the separation of friends; and the traveller would become an exile from his native home,—vainly languishing for the consolatory information that his wife, his children, his kinsmen, his country, were in a state of health and prosperity, and himself still embalmed in their affections. Without this, what to us would be the wisdom of past ages, or the history of former states? The chain of nature would be broken through all its links, and every generation become an isolated and individual world, equally cut off, as by an irremediable abyss, from its ancestors and from posterity. While the language of the lips is fleeting as the breath itself, and confined to a single spot as well as to a single moment, the language of the pen enjoys, in many instances, an adamantine existence, and will only perish amidst the ruins of the globe. Before its mighty touch time and space become annihilated; it joins epoch to epoch, and pole to pole; it gives unity to the works of creation and Providence, and enables us to trace from the beginning of things to the end. It is the great sun of the moral world, that warms, and stimulates, and vivifies, and irradiates, and developes, and matures the best virtues of the heart, and the best faculties of the intellect. But for this, every thing would be doubt, and darkness, and death-shade; all knowledge would be traditionary, and all experience local; civilized life would relapse into barbarism, and man would have to run through his little, and comparatively insignificant, round of existence, the perpetual sport of ignorance and error, uninstructed by science, unregulated by laws, and unconsoled by Revelation. Have I not, then, justly characterized it as the noblest art that has ever been invented by the unassisted efforts of human understanding?

LECTURE XI.

ON THE LITERARY EDUCATION OF FORMER TIMES; AND ESPECIALLY THAT OF GREECE AND ROME.

We have taken a brief survey of the nature of oral language, and of the means devised in different ages and parts of the world to render the transitory ideas it communicates permanent, by means of picturesque or symbolical signs; so that what is once spoken may conveniently be copied or written down, and treasured up for future ages.

It yet remains for us to take some notice of the chief methods that have been adopted in different eras to turn this accumulating treasure or bank of intellectual knowledge to the best account; or, in other words, to develope the mode of education adopted among those nations that have been most celebrated for literary and scientific acquirements, especially in Greece and Rome; and to compare them with the means possessed in our own day, and the general and laudable desire of improvement manifested in every quarter, and prospective of no small addition to the best sort of wealth and prosperity with which a nation can ever be enriched.

We have already traced whatever degree of art or science may have descended from the antediluvian to the postdiluvian race, through the narrow link of human beings preserved in the ark, or whatever the earliest generations of the postdiluvians may have been able to strike out for themselves, to the plains of Babylon as their centre; and observed that, in their radiations from this central point, they have been peculiarly influenced by the political character of the people who cultivated them, and that of the country and the climate in which they took up their abode.

When, in the prosecution of the present subject, we shall come hereafter to examine more particularly into the furniture and faculties with which the mind is endowed, we shall have to show that its chief trains, as well of feelings as of ideas, of passions and rational pursuits, have derived a strong tinge from these circumstances.

Of the birth or first growth of the Grecian states we know little or nothing, though we are made acquainted with the region from which they sprang. The exquisite beauty of the country in which they had the good fortune to fix themselves; its rich and picturesque variety of hill and dale, the spontaneous fertility of its soil, the sweetness of its temperature, the almost unbroken serenity of its skies, and the smooth and glassy sea that surrounded and deeply indented its coasts, harmonized all the ruder passions, and called forth the noblest and finest feelings of the soul. They soon began enamoured of the graceful and the beautiful; their language was melody, and they were led by nature to delight in music, poetry, and painting, from the first. Hence these are the eldest employments we find them cultivating; the earliest historians were their rhapsodists, Homer, Hesiod, and the writers whose works constituted the very valuable Epic Cycle of Greece; a work, unhappily, long lost to the world, and from which Statius is supposed to have drawn the materials of his Thebaid.* Their earliest artists were their musicians; as Orpheus, and the priests of Cybele, and others of like power; the first of whom is represented not only as having harmonized the passions of men, but broken the ferocity of the beasts of the forest, and even tranquillized the tortures of the infernal regions. And of their early knowledge of colours and the art of designing we have a sufficient proof in various passages of the Cyclic poets that have reached us; while in Homer we have occasional references to their being applied, and by ladies, through the medium of tapestry, to the most important subjects of history. Thus Iris, in the third book of the Iliad, finds Helen occupied in representing in tapestry the evils which the Greeks and Trojans had suffered on her account in their battles; and when Andromache first heard the melancholy tidings of the death of Hector, she was engaged in a similar occupation. These, indeed, were employments of Trojan ladies, but what was common to them must have been common, also, to their neighbours of Greece.

Among the Greek states, however, that of Athens was by far the most renowned for its love of letters and science; and amidst the different eras which the Athenian history comprises, that of Pericles may be selected as affording the fairest specimen of the manner in which education was conducted, general learning and a knowledge of the arts acquired and disseminated, philosophy taught, and society cultivated and polished. This era may be regarded as contemporary with the reign of Artaxerxes the First of Persia, and Alexander the Second of Macedon, the rebuilding of the temple at Jerúsalem under Nehemiah, and the establishment of the decemvirs at Rome: and, if we extend its range through an entire century, as, for example, from the middle of the fourth to the middle of the third century before the birth of our Saviour, it will just reach from Herodotus to Demosthenes, and will, besides these celebrated characters, include the existence of Euripides, Sophocles, and Aristophanes, among the poets; Thucydides, Xenophon, and Marsyas, among the historians; Lycias, Isæus, Isocrates, and Æschines, among the orators and rhetoricians; Socrates, Timæus Ocellus, Aristippus, Diogenes, Plato, Aristotle, and Epicurus, among the philosophers; Eudoxus, among the astronomers; and Apelles, among the painters.

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* For the particulars of this celebrated work, see note in vol. ii. pp. 262, 263. of the author's Translation of Lucretius.

The elementary branches of education were acquired among the Athenians, as among ourselves, sometimes by private instruction, but more generally by public schools; many of which, at the period I am now adverting to, had attained a very high degree of reputation, and were crowded with youths from other Grecian states, and even from foreign countries. For the first five or six years, however, not the smallest effort was made to improve the mind; the whole of this period of time being devoted, agreeably to the advice of Plato, and even of many earlier sages, to sports and pastimes, for the purpose of giving strength to the body; exercises which were even afterwards continued with the greatest punctuality, under particular regulations, and constituted a very important branch of Athenian education. In this respect they seem to have imitated the example of the Persians, who never commenced training their children till they were five or six years old, not even those of royal birth. At the age of five or six, the rising generation of Persia were placed under the care of their magi, or men of letters, and combined a course of gymnastics with a course of moral science: the former consisting in learning to ride, to shoot with the bow, and to fight on horseback; the latter embraced and inculcated the valuable habits of honesty and speaking the truth, patience, sobriety, reverence to parents, and the practice of every other virtue. With them literature was subservient to morals.

The general circle of study among the Greeks is well known to have comprised the seven liberal arts of grammar, rhetoric, logic, arithmetic, music, geometry, and astronomy. Of these the two first, or grammar and rhetoric, were commenced earliest, and occupied by far the greatest attention of the scholar: for poetry and declamation were now the most fashionable pursuits, and the Greek language was criticised with an accuracy amounting even to fastidiousness, for new niceties and turns of expression, both in prose and verse; the sense itself being often sacrificed to the sound, as a matter of subordinate consideration. Nor was the time of the student allowed to be infringed upon by the acquisition of any other language; the vanity of the Greeks inducing them to regard almost all other nations as barbarians; and only a few of their philosophers thinking it worth while to make any sort of inquiry into the literature of remote countries.

Next to a critical initiation into their native language under the most celebrated grammarians, the chief object of Athenian education was, as I have just observed, to strengthen the body and give pliancy to the muscles by athletic exercises ; for which purpose three magnificent establishments were instituted and supported at the public expense, consisting of an extensive range of buildings surrounding gardens that were defended by groves, porticos, and shady walks, from the rays of the mid-day sun, and still further cooled and embellished by sheets of limpid water. These schools were called gymnasia, and comprised the Lycæum, the Cynosarges, and the Academy. Here the Athenian youth were instructed in the arts of wrestling, leaping, boxing, tennis, and foot-racing. In different parts of the buildings, large and commodious halls, duly provided with seats, were allotted to the philosophers, rhetoricians, and sophists ; and in these halls the students were completed in the higher branches of instruction. At the age of eighteen the young Athenian had his name formally enrolled in the register of that division of the curia or militia of which his father was a member, and at twenty was admitted to all the rights and privileges of citizenship, and might plunge as soon as he chose into a contest for its honours and emoluments ; or, if he were able, set up a magnificent establishment, and endeavour to distinguish himself at the chariot and horse-races.

The education of Athenian females was for the most part very limited. Those of the middle ranks of life were seldom taught any thing more than to read, write, sew, prepare wool for clothing, and superintend domestic concerns ; while even the higher ranks, or those who were educated with more refinement, independently of this general knowledge, were only instructed how to take some part in the public festivals and other religious ceremonies of the country : such as that of carrying the sacred baskets on their heads, or of joining in the hymns and sacred dances. Upon this point, however, no expense was deemed too costly, that could endow them with the requisite arts of modulating their voices and measuring their steps ; no pains or sacrifice too extravagant that could bestow upon them elegance of shape and gracefulness of motion. Nor is this to be wondered at, since, excepting on such occasions, Athenian females, above the lower classes, seldom appeared abroad, and perhaps never without having their faces veiled. The married women, indeed, were allowed to receive and return visits among themselves, but even these were never permitted to be present at their husbands' parties, though the latter occasionally joined them at their own houses, and had the liberty of introducing their more intimate friends and companions. So that, among the female sex, none but those of acknowledged licentious manners had even an opportunity of becoming acquainted with the general literature, or literary characters, of their own times ; whence, with a singular subversion of the very principles of their system of ethics, such persons were often noticed and even visited by philosophers and moralists.

Education, therefore, among the Athenians appears rather to have been directed to purposes of elegance and accomplishment than to the acquisition of useful knowledge. To possess the first dignities of the state ; to be applauded in the assemblies of the people, or at the bar ; to bear away the prize tripods at the palestræ, or public places for games of exercise among men, as the gymnasia were for youths, or the prize-crowns at the theatre, were the chief objects of ambition among the more active. While the great body of citizens idled away almost the whole of their leisure hours by sauntering on the pleasant banks of the Ilissus, or in the agora, or great square of the city, frequenting every shop in succession, and especially those of the perfumers, in quest of news, for which they had an insatiable thirst; indulging their well-known vein of wit and keen satire upon passers and passing events, or listening to the declamations of sophists, and other noisy disputants.

A few clubs of wits are occasionally to be met with in the present epoch of the history of this people; and a few select assemblies for polite literature and elegant conversation: of which last the most remarkable, perhaps, was that held at the house of the celebrated Aspasia; since it was attended by Socrates and Alcibiades, as well as by almost every other scholar or philosopher of reputation, and by all the most renowned artists of the day. But we meet with no public establishment for a general course of science like that of the universities, or the Institutions (as they are called) of our own times, excepting their schools, nor with any public library of much note, except that of Pisistratus, which was carried away by Xerxes into Persia before the epoch, to which our attention is now directed, commenced.

Private libraries, however, were not uncommon, though seldom extensive. Those of Aristotle, of Theophrastus, and of Euclid, the founder of the school of Megara, were perhaps the largest and most valuable. The art of printing being unknown, books were rare, and copied with great difficulty and expense; sometimes by individuals for their own benefit; but more generally by professional transcribers, who formed a distinct trade. The great mass of Athenians, moreover, though of exquisite taste and elegance, and certainly wealthier than most of the other Grecian states, seldom displayed those splendid fortunes which were so common in Persia. A freehold of the value of fifteen, or twenty talents, (about four or five thousand pounds sterling) raised a man considerably above the middle ranks of life. The father of Demosthenes was esteemed rich, the whole of whose property on his death amounted to not more than fourteen talents, 3150*l.* sterling. Plato appears to have given a hundred minæ, or 375*l.* for three small treatises by Philolaus.* But this was a costly purchase: for Aristotle bought the whole library of Speusippus, small indeed, but select, for three talents, or 675*l.*†

Hence the trade of bookselling at Athens was generally upon a limited scale, and usually engaged in by persons of but little property, whose stock consisted mostly of books of mere amusement; a part of which however was often sent to the adjacent countries, and sometimes as far as to the Greek colonies on the coast of the Euxine.‡

In respect to books, and the possession of public libraries, ROME was far more fortunate than Athens; and I shall now hasten to a brief survey of its literary and scientific character in what may be regarded as its most classical and cultivated era; not the Augustan age, which has usually been contemplated as such, but that which immediately preceded it, reaching from the dictatorship of Sylla to the establishment of Augustus, and of course terminating a few years before the birth of our Saviour.

The Romans, who had hitherto devoted themselves altogether to arms and agriculture, and who had even despised eloquence, and paid no attention to the improvement of their native tongue, became attached to literature all of a sudden. The Achæans were accused by the Roman people of having acted hostilely towards them; and a thousand of them were sent as deputies, or rather as hostages, to plead their cause, and obtain the best terms they could for their country before the senate of this aspiring republic. Contrary, however, to the engagement stipulated with them, they were not allowed to enter upon their defence; were scattered over different parts of the republic; forbidden to appear before the senate; and detained, in a state of captivity, for not less than seventeen years. For the most part these Achæans were men of taste and elegant accomplishments, and many of them were scholars of profound and diversified erudition. Such, more especially, was Polybius, who was soon introduced into public favour under the patronage of Scipio Æmilianus, and whose elegant Greek writings were now read and studied by every one. The whole republic became enamoured of the various acquisitions of its new, but mistreated visitants; and in matters of polite literature the conquerors soon yielded to the conquered. Hence schools for the study and exercise of rhetoric and eloquence, superintended by native Greeks, became in a short time so frequent, that scarcely a Roman youth was to be found who would engage in any other avocation; and the whole body of Greek philosophers and rhetoricians, that remained after the return of the Achæan deputies, were expelled by a decree of the senate during the consulship of Caius Fannius Strabo, and Valerius Messala, in the year of the city 592, in consequence of the ascendancy they had acquired over the public mind.

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* Diog. Laert. in Plat. lib. iii. sec. 9. viii. 85.

† Diog. Laert. in Speus. lib. iv. sec. 5. Aul. Gell. iii. 17.

‡ Xenoph. Exped. Cyr. lib. vii. p. 412. Travels of Anacharsis (Engl. vers.) iii. 130.

This expulsion, however, was too late; a general taste for Grecian literature had been caught, and the classical contagion had spread universally. Polybius was still studied, and the consul Rutilius Rufus had published, in elegant Greek, a history of his own country. The Greek scholars, indeed, were still farther avenged a few years afterwards, by the general comparison which was drawn between their own genuine taste, and that of the tribe of Latin sophists and declaimers, who, in consequence of their banishment, had sprung up and occupied their place: men who were bloated with conceit, instead of being inspired by wisdom; and who substituted the mere tinsel of verbiage for the sterling gold of perspicuous argument and fair induction. With this foppery of learning, the Roman government soon became far more disgusted than with the seductive talents of the Greek teachers; and hence, in the year of the city 661, during the censorship of Crassus, the Latin declaimers shared the fate of their predecessors, and were formally banished from Rome.

In their own language, therefore, we meet with but few successful specimens of prosaic eloquence down to this period: yet Cato the censor, Lælius, and Scipio were orators of no inconsiderable powers, and eminently, as well as deservedly, esteemed in their day. In poetry, however, the republic had already a right to boast of its productions; for Andronicus, Nævius, and Ennius had long delighted their countrymen with their dramatic as well as their epic labours: Pacuvius, and Accius, Plautus, Cæcilius, and Afranius had improved upon the models thus offered them in the former department, and Terence had just carried it to its highest pitch of perfection.*

Public museums also, libraries, and collections of valuable curiosities of all kinds from Greece, Syracuse, Spain, and other parts of the world were, at this period, becoming frequent and fashionable. Italy was never more emptied of its elegancies and ornaments by Buonaparte, than Syracuse was by Marcellus, when stratagem and treachery at length gave him an admission into the city. In the forcible words of Livy, "he left nothing to the wretched inhabitants, but their walls and houses." Spain and Africa were in the same manner ransacked by the elder Scipio; Macedon and Lacedæmon by Flaminius; Carthage by Scipio Africanus; and Corinth, in the very same year, by Mummius. Nothing, however, can afford a stronger proof of the general want of taste for the fine arts among the Romans, even at this period, than the threat given by Mummius to the masters of the transports to whom he committed his invaluable pillage of the best pictures and statues of Achaia, that if they lost or injured any of them he would oblige them to find others at their own cost. In addition to which I may also observe, that Polybius, who was at this time with the Roman army, found a party of Roman legionaries, shortly after the capture of Corinth, playing at dice on the Bacchus of Aristides; a picture so exquisitely finished as to be accounted one of the wonders of the world. Not knowing the value of it they were readily persuaded to part with it for a more convenient table; and when the spoils of Corinth were afterwards put up to sale, Attalus, king of Pergamus, a much better judge of painting than the Roman soldiers, offered for it six hundred thousand cesterces, or about five thousand pounds sterling. Mummius, the Roman consul and general, disbelieving that a picture of any kind could be so valuable of itself, thought it must contain some magical virtue in it; and hence would not allow it to be parted with, notwithstanding the remonstrances of Attalus. He did not, however, appropriate it to his own use, but placed it in the temple of Ceres, where Strabo informs us he had the pleasure of seeing it not long before it was consumed in the fire by which that temple was reduced to ashes.*

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* See the author's life of Lucretius prefixed to his translation of the poem De Rerum Natura.

But the library and museum of most importance at this period, and which most attracted the attention of the Romans, was that established under the patronage and superintendence of the illustrious L. Æmilus Paulus; and consisted of an immense number of volumes, statues, and paintings, which he had imported from Epirus, upon the general plunder and destruction of that unfortunate country, in consequence of its adherence to Perses king of Macedon, and which had been accumulating ever since the reign of Alexander the Great. This early and valuable collection was continually augmented by presents of other books from men of letters or warriors, into whose hands they occasionally fell as a part of the public spoil: but was more indebted to Lucullus, who had studied philosophy under Antiochus the Ascalonite, than to any one else; and who, about the middle of the seventh century of the city, added to it the whole of the royal library he had seized from Mithridates, upon his conquest of Pontus.

Yet the transplantation into the Roman capital of the extensive and invaluable libraries of Aristotle and Theophrastus contributed, perhaps, more than any other circumstance to inflame the Roman people with a love of Grecian literature. This was effected by the conquest of Sylla, and anteceded the public present of Lucullus by about fifteen years. These unrivalled libraries were the property of Apellicon of Teia, who had accumulated an immense collection of books of intrinsic value at an incredible expense. Apellicon does not appear to have been, in any respect, a scholar: but he was a man of inordinate wealth; and, as it sometimes occurs in the present day, a library was his hobby-horse, and the greater part of his rental was expended in augmenting it. For this purpose he ransacked all the public and private collections of books in Asia: he surpassed, in many instances, the offers even of the kings of Eumenes and Mithridates, for valuable volumes that had become scarce; and when he was precluded from purchasing, he frequently induced the librarians, by considerable presents, to steal for him. During the first war, however, between Mithridates and the Roman republic, in which Sylla ultimately triumphed, and acquired a high degree of personal glory, Athens, in an evil hour, had united her fortunes with those of the Asiatic prince; and hence, at the conclusion of the war, was left totally at the mercy of the Roman conqueror. Sylla appears to have thrown a wishful eye upon every thing of value that lay within his reach: and having sacrilegiously invaded the groves of Academus and the Lyceum, the library of Apellicon was one of the next objects that captivated his attention. He was determined to add it to his other treasures. Force, however, was now become unnecessary: for at this very moment the book-worm Apellicon died, and he met with no resistance from his relations.

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* Strab. lib. viii. p. 381.

The Romans, by thus enriching themselves with the spoils of all the world, became possessed of an influx of wealth that enabled most of the citizens to gratify themselves, not only in this respect, but in almost every other that merely depended upon money. Of the wealth of various individuals, we may form some opinion by the following anecdote. Cæsar, by his unlimited liberality in furnishing shows to the people, had incurred a debt to an enormous amount; and when on the eve of setting out for Spain, the province that fell to him after his prætorship, was abruptly stopped by his creditors. On this occasion Crassus stood forward as his surety, for more than two millions of our own money* (bis millies et quingenties,) or, in exact English calculation, 2,018,229*l.* 3*s.* 4*d.* sterling.

But the literature of Greece was, nevertheless, best to be acquired in Greece itself; and the Romans, though they transplanted books, could not equally transplant the taste and spirit that produced them. Athens, although plundered of her richest ornaments, shorn of the glory of her original constitution, and dependent upon Rome for protection, had still to boast of her schools and her scholars. Every scene, every edifice, every conversation, was a living lecture of elegance and erudition. Here was the venerable grove in which Plato unfolded his sublime mysteries to enraptured multitudes;—here the awful Lyceum, in which Aristotle had anatomized the springs of human intellect and action;—here the porch of Zeno, still erect and stately as its founder;—and here the learned shades and winding walks of THE GARDEN of Epicurus, in which he delineated the origin and nature of things, and inculcated tranquillity and temperance. Here Homer had sung, and Apelles painted; here Sophocles had drawn tears of tenderness, and Demosthenes fired the soul to deeds of heroism and patriotic revenge. The monuments of every thing great or glorious, dignified or refined, wise or virtuous, were still existing at Athens; and she had still philosophers to boast of, who were worthy of her fairest days, of her most resplendent reputation.†

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* Stewart's Life of Sallust, i. p. 135; Plut. in Jul. Cæs. p. 712, ed. Francof. Suet. in Jul. Cæs. xviii.

† See the author's Life of Lucretius, prefixed to his Translation of the Nature of Things, p. xxix.

To this celebrated city, therefore, this theatre of universal learning, the Roman youth of all the first families were sent for education. And at the period we are now contemplating, we meet with the following names, as co-students, and chiefly attendants upon the Epicurean school, forming a most extraordinary concentration of juvenile talents and genius: Tully, and his two brothers Lucius and Quintus, the last of whom was afterwards a poet, and as signally distinguished in the profession of arms, as the first was in that of eloquence; Titus Pomponius, from his critical knowledge of the Greek tongue surnamed *Atticus*, but who derives this higher praise from Cornelius Nepos, that "he never deviated from the truth, nor would associate with any one who had done so;" Lucretius, author of the well known poem on the Nature of Things; Caius Memmius, the bosom friend of Lucretius, of whose talents and learning the writings of Tully offer abundant proofs, and to whom Lucretius dedicated his poem; Lucretius Vespilio, whom Cicero has enumerated among the orators of his day; Marcus Junius Brutus, Caius Cassius, and Caius Velleius, each of whom immortalized himself by preferring the freedom of his country to the friendship of Cæsar. And when to these I add the names of the following contemporaries, most of whom, we have reason to believe, were also co-students at Athens with those just enumerated—Julius Cæsar himself, Crassus, Sulpitius, Calvus, Varro, Catullus, Sallust, Hortensius, Calpurnius, Piso, Marcus, Marcellus, whose son Caius married Octavia, the sister of Augustus, Atheius, and Asinius Pollio, to whom Virgil dedicated his fourth eclogue, and who founded, expressly for the use of his country, one of the most splendid and extensive libraries the public were ever possessed of, collected from the spoils of all the enemies he had at any time subdued, and still further enriched by him at a vast expense,—we meet with a galaxy of talents and learning, which neither the Augustan nor any other age in the whole history of the Roman republic can presume to rival.

It was the son of Octavia whose ripening virtues and untimely death Virgil is so well known to have referred to in the pathetic tribute introduced into the vision of Æneas:

> Heu miserande puer! si qua fata aspera rumpas,
> Tu Marcellus eris.*
>
> Ah! could'st thou break, lov'd youth! thro' fate's decree,
> A new Marcellus should arise in thee.

This accomplished youth, the delight of the Roman people, appears to have been well entitled to so high a compliment. It was the intention of his uncle Augustus that he should succeed him, and Virgil received from Octavia, for the verses that related to Marcellus, a pecuniary present of the value of 2500*l.*

Cicero acted wisely, therefore, in sending, as he expressly declares he did, all his young friends to Greece, who evinced a love for study, "that they might drink from fountains rather than from rivulets." "Meos amicos, in quibus est studium, in Græciam mitto: id est ad Græciam ire jubeo: ut ea à fontibus potius hauriant, quàm rivulos consectentur."†

Horace alludes to the same seat of learning, and nearly the same habit of studying there in his own case, by way of finishing his education, after having read Homer at home:

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* Æneid. vi. 881.

† Acad. Quest. i. 2.

Romæ nutriri mihi contigit, atque doceri,
Iratus Grajis quantum nocuisset Achilles.
Adjicere bonæ paulo plus artis Athenæ:
Scilicet ut possem curvo dignoscere rectum,
Atque inter silvas Academi quærere verum.*

At Rome I first was bred, and early taught
What woes to Greece Achilles' anger wrought.
Famed Athens added some increase of skill
In the great art of knowing good from ill;
And led me, yet an inexperienced youth,
To academic groves in search of truth.

BOSCAWEN.

Nor were other branches of science, or even the extensive circle of arts and manufactures forgotten in the midst of the fashionable study of philosophy and literature, either at Rome or in the Greek states. We have not time to enter into a survey of the very extensive, and, in various respects, accurate views that were taken of many of the most important pursuits of our own day, and the activity with which they were followed up. In statuary and architecture, as well as in poetry and eloquence, the models of ancient Rome, as well as of ancient Greece, are still the models of our own times. We have already touched upon the skill of the Greek masters in the art of designing; which they practised with great perfection in every diversity, from simple outline or linear drawing, to every variety of silhouette, or light and shadow, as well as every kind of painting with colours; while in one or two varieties they went far beyond our own day, as in encaustic painting, both on wax and on ivory; a branch of the art, which has, unfortunately, been lost for ages, yet the most valuable of all, as being the most durable. Their acquirements are truly astonishing in almost every ramification of invention or execution that the mind can follow up; and the progress which we have still proofs of their having exhibited in metallurgy, crystallography, mirrors, mineralogy, chemistry, mechanics, navigation, optics and catoptrics, weaving, dyeing, pottery, and a multiplicity of other manufacturing or handicraft trades, must appear incredible to those who have not deeply entered into the subject. Their splendid purple cloths,—Babylonica magnifico colore,—have, perhaps, never been equalled since; the immense and fearful machinery invented by Archimedes, at Syracuse, for laying hold of the largest and most formidable Roman galleys with its ponderous and gigantic arms, and whirling them with instantaneous destruction into the air, as they approached the walls of this famous city during its siege;—the burning glasses contrived by him for setting them on fire at a distance, by a concentration of the sun's heat alone;—their knowledge of the existence and fall of meteoric stones—not many years ago laughed at as a chimera among ourselves; and the adumbration, to call it by no stricter term, with which the grand principles of the Copernican system of the heavens was approached by Nicetas, Philolaus, Aristarchus, and other disciples of the Copernican school—are, I trust, sufficient proofs of the truth of this remark, though hundreds of other examples might be added to the list.†

Still, however, the observation I have made with respect to the education and study of the Athenians applies with considerable, though not altogether with equal force, to those of the Romans. Elegance and accomplishment seem rather to have been the chief objects of attainment than deep physical and analytical science. Polite literature and statistics were almost swallowed up in the vortex of natural philosophy; and logic, or rather dialectics, usurped the place of induction. Rome, moreover, like Athens, does not appear to have been possessed of any public establishment for a general course of science, similar either to the universities or the Institutions of the present day.

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* Epist. Lib. II. ii. 41.

† On a former occasion the author had an opportunity of following up and developing this interesting subject at considerable length; and those who are desirous of pursuing it with him, may turn to the running commentary to his Translation of Lucretius, vol. i. p. 338. 414. vol. ii. p. 50. 131. 135. 154. 159. 401. 491. 568.

There are various writers who have endeavoured to draw up lists of Greek and Roman names, from the books that have descended to us of persons who were celebrated, in their respective eras, in different branches of the arts and sciences. Among the most complete of these are the tables of the Baron de Sainte Croix, of the Academy of Belles Lettres: and as nothing can give us a clearer idea of the prevailing taste and inclination of a people, than a comparison of the numbers of those engaged in one department with those engaged in others, I have taken some pains to form, from these tables, an estimate to this effect. The tables extend through nearly the whole range of Grecian history, (though they are confined to that history,) from the uncertain time of Orpheus and Cadmus, to that of Euclid; or, in other words, from the commencement of the twelfth or thirteenth, to the close of the third century before the Christian era.

They contain the names of 863 persons, as artists or men of literature: and upon arranging them into their different classes, I find the relative proportion as follows:

Legislators and Philosophers - - - - -	152
Orators, Rhetoricians, and Sophists - - - -	54
Grammarians, Editors of early works, and Critics - -	13
Astronomers, Mathematicians, and Geometers - -	38
Physicians - - - - - - -	28
Zoologists and Agricultural Writers - - - -	12
Geographers and Navigators - - - - -	17
Mechanics - - - - - - -	9
Founders and Metallurgists - - - - -	6
Engravers - - - - - - -	7
Architects - - - - - - -	32
Statuaries and Sculptors - - - - -	95
Poets, Painters, and Musicians - - - - -	400
	863

Hence it appears, that far more persons were engaged in the two last classes, or those of poetry, music, and painting, and of statuary and sculpture, than in all the other classes collectively; that next to these, the legislators and philosophers were most numerous, and then the orators, rhetoricians, and sophists; that but little comparative attention was paid to natural history and agriculture, and still less to mechanics; and that not a single name has reached us in the departments of mineralogy, statics, hydrostatics, trades, and manufactures; to say nothing of chemistry and pneumatics, which may principally be regarded as sciences of modern times.

That several of these latter departments were studied to a certain extent is unquestionable; but it is also equally unquestionable that that extent must have been very limited, since otherwise the names of those who had studied or cultivated them must have descended to the present day in some of the writings that have reached us.

This comparative view of the arts and sciences of Greece may, with little variation, be applied to those of Rome. The study of the fine arts, however, was here less extensive; and the race of orators and political demagogues, in consequence of the peculiar character of the government and of the people, more numerous. Natural history and agriculture, moreover, appear to have made more progress, and various branches of trade and manufacture to have been cultivated with more success.

Upon the whole, however, Rome added but little to what she derived from Greece: nor has much been added in any subsequent era, or by any nation amidst which the variable fortunes of science and literature have compelled them to take shelter, till within the course of the last two centuries; towards the beginning of which period, Lord Bacon observed, with not more severity than correctness, that "the sciences which we profess have flowed almost entirely from the Greeks; for those which the Roman or Arabian, or still later writers, have added, are but few, and these few of but little moment; and, whatever they may be, are built upon the foundation of what the Greeks invented; so that the judgment, or rather the prophecy of the Egyptian priest, concerning the Greeks, is by no means inapplicable, 'that they should always continue boys, nor possess either the antiquity of science, nor the science of antiquity.'"*

It remained for this extraordinary character, who thus fairly estimated in his own day the value of ancient and modern learning, to break through the spell which fatally pressed upon it, and seemed to prohibit all further progress. It is to Bacon, and almost to Bacon alone, that we are indebted, if not for the scientific discoveries that have enriched the last two centuries, and struck home to every man's business and bosom, at least for that mode of generalizing the laws of nature, and of connecting the various branches of the different arts and sciences, which have chiefly contributed to those discoveries; which have called mankind from the study of words to the study of things, and have established from the book of nature the truth of that maxim, which had hitherto only loosely floated in the books of the poets, that

> All are but parts of one stupendous whole.

It was my intention, in proof of this assertion, to have taken a brief survey, even before we closed the present lecture, of the shifting scenes of science and literature from the decline of the Roman Empire to their re-establishment in the fifteenth and sixteenth centuries; to have given a glance at them in their retreat amidst the eastern and western caliphats, in what have usually been called the dark ages of the world, extending from the fifth, but especially from the seventh to the fifteenth century; to have contemplated them on their re-appearance and first spread, their resurrection and restoration to life and action, under the fostering providence of the illustrious houses of Medici, Urbino, Gonzaga, and Este; from which last, the most ancient and most distinguished of the whole, our own royal family derive their descent; to have surveyed them as basking under the patronage of Leo X.; but especially as they were affected by the wonderful and all-controlling influence of the Reformation which occurred during his papacy; and to have compared the character they then assumed, with that which they exhibit in our own day;—but, interesting as the subject is, I am compelled by want of time to postpone it till our next lecture, when I shall return to the subject, and carry it forward as the period will allow.

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* Nov. Org.

I shall only further observe, that, on the first reviviscence of literature, it was chiefly limited to classical and philosophical subjects, and confined to the courts of princes, or the walls of universities, which were now established in almost every state of Europe; the classical or ornamental branches being mostly cultivated in the courts, and the speculative or philosophical in the schools. And such, with little variation, continued to be the course of learning, till the appearance of that great luminary in the hemisphere of letters to whom I have just adverted. No sooner, however, had the writings of Bacon and of other characters of a similar comprehensiveness of mind, who co-operated in his views, become diffused, than institutions of another class were found wanting:—a something that might fill up the space between the cloistered scholar and the irrecondite citizen; the dry principles of speculative science, and the living practice of the artist and the mechanic. And hence, academies and societies for natural knowledge became organized and incorporated—museums were founded—taste, ingenuity, and invention commenced a happy intercourse—the general results of their communications were, for the most part, periodically published, and the great mass of mankind became more generally enlightened than in any former period of the world.

But a mode of acquiring a familiar and systematic initiation into the general circle of the arts and sciences, was still felt desirable for the body of the people; a sort of rudimental education, by which they might be able to assist and appropriate the knowledge that was flowing around them in every direction; that might call forth their own energies and resources, and reflect with increased lustre the light in which they were walking. And hence have arisen these scientific schools which are now commonly known by the name of Institutions; and especially, if I mistake not, the school I have the honour of addressing.

An establishment of this kind, to be perfect, should be possessed of a library adequate to every inquiry—a laboratory and a museum of equal extent, and a course of instruction commensurate with the whole circle of the sciences. Such an establishment, however, is not to be expected; and especially in our own country, where the government is seldom solicited for assistance, and the sole endowment results from the joint patronage and contribution of individuals. All that remains for us, therefore, is to make the best use of the means that are in our power, and to carry them to the utmost extent they will reach; and I can honestly congratulate the members of the Institution before me, with having, in this respect, conscientiously acted up to the fullest limits of their duty, and of having rather set an example than followed one; for it is a matter of notoriety to the world at large, that there is no other Institution in which the same measure of income has been extended to the same measure of acquiring knowledge, whether by books or by lectures.

LECTURE XII.

ON THE MIDDLE OR DARK AGES.

If we examine the history of Europe in a literary point of view, we shall find it consist of three distinct periods—an era of light, of darkness, and of light restored. To the first of these periods I directed your attention in the preceding lecture. We noticed the general state of literature and the mode of education adopted in Greece and Rome, at the most splendid epochs of these celebrated republics, and briefly compared them with the means of acquiring knowledge in our own day; and we at the same time glanced rapidly at the intervening space, or middle period; or rather only touched upon a few of its leading features, from an impossibility of compressing even a miniature sketch of its history into the limits of a single lecture; though it may be remembered that I threw out a pledge of returning to the subject on the present occasion, and of investigating it in a more regular detail.

A part of that pledge I shall now, by your permission, endeavour to redeem; by taking a survey of the general literature, or ignorance of mankind, which characterized that wonderful era which has usually been described by the name of the DARK, or MIDDLE AGES; and which extends from the fall of Rome before the barbarous arms of the Goths, in the fifth century, to the fall of Constantinople before the equally barbarous arms of the Turks, in the fifteenth century; thus comprising a long afflictive night of not less than a thousand years; yet occasionally illuminated by stars of the first magnitude and splendour: and big with the important events of the sack of Alexandria and the destruction of its library; the triumph and establishment of the Saracens, and their expulsion from Spain; the devastation of Europe, and the overthrow of its ancient governments in favour of the feudal system, by successive currents of barbarians from the northwest of Asia, pouring down under the various names of Alans, Huns, Ostro-goths, and Visi-goths, or eastern and western Goths; sometimes in separate tides, and sometimes in one united and overflowing flood; the deliriums of chivalry, of romance, and crusading; the introduction of duels and ordeals; of monkery and the inquisition; the separation of the eastern from the western church; and the first gleams of the Reformation, under the fearless and inflexible Wyckliff. And, in our own country, the descent of Hengist on the isle of Thanet; the establishment of the Saxon octarchy; the general sovereignty of Egbert; the glorious and golden reign of Alfred; the conquest of the Norman invader; the bloody feuds of the houses of York and Lancaster; and their termination, on the union of the two families, after the memorable battle of Bosworth.

This will lead us to the fair epoch of the revival of letters under the patronage of Leo X., and the still more commanding influence of the Reformation; a period, however, upon which it will be impossible for us to touch in the course of the present inquiry, though I shall still bear it in memory, and request your attention to it on a subsequent opportunity.

The literary taste and pursuits of Rome continued nearly the same under her emperors as during her republican form of government. Athens was still the alma mater of the higher ranks of her youth; and, as she increased in opulence and in luxury, she resigned herself more fully to those Grecian blandishments which were despised under the commonwealth.

On the death of Constantius, which took place in our own city of York, in the year of our Lord 306, for even Britain had at this time bowed down, through a large extent of her territory, before the mistress of the world; Constantine, his favourite son, was, agreeably to his father's will, proclaimed emperor in his stead. Galerius, however, who was co-emperor with Constantius, opposed this regulation, and endeavoured to secure the whole of the empire to himself; while various other chieftains taking advantage of the public confusion, not less than four competitors assumed the imperial purple at the same time. It was the good fortune of Constantine to triumph over all his rivals; and having at length securely seated himself on a throne whose dominion extended over almost the whole of Europe, and a considerable part of Asia and Africa, he resolved upon building a new imperial city, more immediately in the centre of his dominions; and for this purpose chose the spot of the ancient Byzantium, than which the whole globe could not offer a more auspicious situation, whether in regard to climate, commercial intercourse, or defence. The walls of Byzantium rose on the Thracian coast of the Propontis, or modern Sea of Marmora; secured by the key of the Thracian Bosphorus on the left, which gave an entrance to the Euxine, and the whole interior of the north; and by the key of the Hellespont, or Dardanelles, as it is now called, on the right, directly opening into the Archipelago, and communicating with every other part of the world; the whole of civilized Europe lying immediately behind, and Asia and Africa immediately in front; surrounded by all those scenes which had been richest in harvests of Grecian glory, and had chiefly contributed to immortalize the Grecian name. The language was Greek, the country was Greek, and the customs and manners still possessed that mildness and suavity which so peculiarly characterized this polished people; and which, in no inconsiderable degree, have descended to the present hour. The city, thus erected, the Roman emperor called after his own name, Constantinople; he removed the court to it from the old metropolis, and by the enormous sums he expended upon it, and the encouragement and patronage he lavished upon settlers of every kind, and especially upon men of letters and artists, he beheld it, in a few years, rivalling the magnificence, and even the extent of Rome itself. He endowed it with the same rights, immunities, and privileges; and established an equal senate, equal magistracies, and other authorities, and declared it to be the metropolis of the East, as Rome was that of the West. Constantinople is also worthy of attention on another account, as being the first city in the world that was dedicated by the authority of the government to the service of the Christian religion.

The fact of Constantine's conversion is too important, and the means by which it was accomplished too singular to be passed by on the present occasion; and that I may not be suspected of exaggeration or undue embellishment, I shall give it you in the plain, unvarnished words of the very cautious and authentic writers of the Ancient Universal History.

In describing the war in which Constantine was involved with Maxentius, his most powerful competitor for the empire, they thus observe, at the same time giving their authorities, as they proceed, with an indefatigable research, and weighing them with a scrupulous circumspection which has rarely been equalled in later times: "In this war Providence had something in view, infinitely more important than the rescuing of Rome from the tyranny of Maxentius; nothing less than the delivering of the church from the cruel persecution under which it had groaned for the space of near three hundred years. Constantine had inherited of his father some love and esteem for the Christians; for the first use he made of his authority was to put a stop to the persecution in the provinces subject to him. However, he had not yet shown any inclination to embrace a religion which he both honoured and esteemed; but in the war with Maxentius, apprehending that he stood in need of an extraordinary assistance from heaven, he began seriously to consider with himself what deity he should implore as his guardian and protector. He revolved in his mind the fallacious answers given by the oracles to other princes, and the success that had attended his father Constantius in all his wars, who despised the many gods worshipped by the Romans, and acknowledged only one Supreme Being. At the same time he observed, that such of his predecessors as had persecuted the Christians, the adorers of this God, had miscarried in most of their undertakings, and perished by an unfortunate, and untimely end; whereas his father, who countenanced and protected them, had, in all his wars, been attended with uncommon success, and ended his life in the arms of his children.

"Upon these considerations he resolved to have recourse to the God of his father, and adhere to him alone. To him, therefore, he addressed himself with great humility and fervour, beseeching him to make himself known to him, and to assist him in his present expedition. Heaven heard his prayer in a manner altogether miraculous; which, however incredible it may appear to some, Eusebius assures us he received from the emperor's own mouth, who solemnly confirmed the truth of it with his oath. As he was marching at the head of his troops in the open fields, there suddenly appeared to him AND THE WHOLE ARMY, a little after mid-day, a pillar of light above the sun, in the form of a cross, with this inscription:

"CONQUER BY THIS."*

The emperor was in great pain about the meaning of this wonderful vision till the following night; when our Saviour appearing to him, with the same sign that he had seen in the heavens, commanded him to cause such another to be framed, and to make use of it in conquering his enemies. The next morning, Constantine imparted to his friends what he had seen; and sending for the ablest artificers and workmen, ordered them to frame a cross of gold, and precious stones, according to the directions which he gave them. Constantine being, after the miraculous vision, immutably determined to adore that God alone who had appeared to him, sent for several bishops in order to be instructed by them in the mysteries of their religion, and in several particulars of the late apparition. He hearkened to them with the utmost respect, and believed what they told him of the divinity, incarnation, cross, and death of our Saviour, reading with great attention the Holy Scriptures, and consulting in his doubts the bishops whom, for that purpose, he kept constantly about him."†

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* Τȣτω νικα.

† Rom. Hist. b. iii. ch. xxv. vol. xv. p. 554, 8vo. ed. 1747. The account is taken from Eusebius; and by some writers, who find it easier to ridicule than to weigh testimony, it has been called a pious fiction; but with what justice, the following remarks will sufficiently show. First, Constantine and Eusebius are allowed by all parties to have been men of

This extraordinary event having preceded his determination to build a new metropolis, he expressly dedicated the city, as I have already observed, when on the point of being completed, to the service of the religion he had so lately embraced: solemnly consecrating it, in conformity with the custom of the times, to the Virgin Mary, according to Cedrenus, but according to Eusebius, to the God of Martyrs.

Upon his death-bed Constantine divided the empire into five parts; his three sons and two of his nephews being allowed to share the imperial domains between them. The building of Constantinople was a severe blow to the splendour and opulence of Rome; and this partition of the imperial authority was an equal blow to the extent and integrity of the empire at large. The tributary nations of every quarter, as soon as they found that the consolidated force of the empire was thus frittered away, were in arms, with a view of regaining their liberty or of enlarging their boundaries. The Franks and other German tribes broke into Gaul; the Sarmatians into Pannonia, or what is now called Hungary; the Picts, Scots, and Saxons, into Britain; and the Austrians into Africa.

To oppose this general ravage, the imperial dominions were once more consolidated, and not long afterward, in the reign of Valentinian, who admitted his brother Valens to an equal participation in the purple with himself, regularly divided into two distinct empires, under the names of the Eastern, or Greek, and the Western, or Latin empire; the former comprehending Illyrium and Pannonia, or Sclavonia and Hungary as they are now denominated, Thrace, Macedon, Greece, Asia Minor, Egypt, Syria, Palestine, and all the eastern provinces, having Constantinople for its metropolis: and the latter embracing Gaul, Italy, Africa, Spain, and Britain, its metropolis being ancient Rome.

The greater degree of energy manifested by the successors to the eastern empire preserved its boundaries for a considerable period of time free from much mutilation; but the empire of the west, in which Rome, though once more encouraged by the presence and patronage of a splendid court, was never able to recover from the blow it had received by the building of Constantinople, continued to droop from its first establishment. Its successes were few and trivial, and such as rather tended to invite new

general honesty and intelligence, to give them no higher character. Secondly, Constantine declares that the vision of the cross and of the pillar of light, were beheld by the whole army as well as by himself. Thirdly, Eusebius affirms that he gave an account of the whole to the artists for whom he immediately sent, on the morning after his explanatory dream, to construct a standard ornamented with a copy of the golden cross he had beheld, and enriched with jewels, according to the direction he gave them. Fourthly, he tells us that Constantine narrated the same statement to the bishops whom he had assembled to give him spiritual advice on the occasion. And fifthly, that he afterwards gave the whole history of it, in like manner, in his own person, to Eusebius himself; and confirmed the narration with an oath.

All this may, indeed, be said to be nothing more than the declaration of Eusebius alone; but when we add to these remarks, sixthly, that Eusebius published his account in the general face of those to whom he asserts that the emperor communicated it at the time, and in the face of hundreds, perhaps of thousands of the army, who he also asserts beheld the glorious vision, the cross and its motto, as well as the emperor; and that not an individual ventured to step forward and contradict him: and when, lastly, we take into consideration the undisputed fact, that the figure of the cross portrayed in the pillar of light, was copied, together with its motto, and placed on every banner of the imperial army from this time forth; and that all the branches of the imperial family became converts to Christianity from the same period; when all these points are taken into consideration, a case is made out, not only that sufficiently vindicates the veracity of Eusebius, but that probably demands a more miraculous power to shut the heart against its admission, than that of the miracle which is its subject-matter.—See Euseb. Vit. Const. lib. i. cap. xxvii—xxxi. p. 421—423.

hordes of barbarians into the heart of its fairest provinces than to deter from aggression by examples of signal vengeance and severity.

The tide of incursion, as I have already observed, flowed almost entirely from the north. Beyond the Tanais, and immediately crossing the Imaus or Caf of the Caucasus, extending nearly from the banks of this river to the sea of Japan, lay scattered at the commencement of the Christian era, a variety of tribes unknown to the conquering swords of the Roman legions, and distinguished by the names of Vandals, Sueves, Alans, Goths, Huns, Turks, and Tartars. Of all these the Huns appear to have given the earliest proofs of restlessness and love of power: they first pressed forward upon the Goths, who, dispossessed of their native regions, bore down upon the Vandals, Sueves, and Alans; and these, flying before them, entered into Gaul, and from Gaul advanced into Spain; and on being driven from Spain passed over and invaded Africa; thus making way for a farther advance of the Goths and Huns into the centre of the western empire, which they prosecuted sometimes in conjunction and sometimes alone. Hence, even Italy was in several instances over-run, and Rome itself taken and sacked by the Goths under Alaric, towards the beginning of the fifth century; while the Goths themselves were in their turn, about forty years afterward, obliged to fly before the victorious arms of Attila, the Hunnish leader, or to enlist under his banners; a barbarous chieftain, who, descending from the wild and barren mountains of Scythia, spread terror and devastation over almost the whole of Europe; and, possessing a political authority of as extensive a range towards the east, proved a formidable enemy to every sovereign from China to Gaul. The camp of this adventurous and successful soldier, when he was stationary, was pitched on the northern side of the Danube, between the Teiss and the Carpathian mountains; his court was unrivalled in splendour and magnificence, and his empire extended through a range of not less than seven thousand miles in length. On the death of Attila, this enormous, but ephemeral empire, which had only "grown with his growth and strengthened with his strength," insensibly crumbled away. "The Huns were melted down into the nations which they conquered; and, if the modern Hungarians be excepted, whose descent from them is rather a plausible conjecture than a historical fact supported by conclusive evidence, few vestiges of them are now discoverable either in Europe or Asia."*

The history of the Roman empire from this period may be comprised in a few words. Towards the close of the fifth century, during the reign of Augustulus, who had regained possession of the central provinces, it was overthrown by the Herulians under Odoacer, who were themselves shortly afterward expelled from Italy by Theodoric, king of the Ostro-goths. About the year 568, the Lombards, issuing from the mark of Bradenburg, invaded the Higher Italy, as it was named, and founded a powerful state, called the empire of the Lombards; the Middle and Lower Italy being added to the empire of the east by the brilliant conquests of Justinian's celebrated, but ill-requited generals, Belisarius and Narses. These, however, were afterward wrenched from it and incorporated into the new empire of the Lombards; from whom the whole passed, together with almost the entire amplitude of polished Europe, into the hands of Charlemagne, the second sovereign of the second dynasty of the Franks: a people that, having subdued all Gaul, had established themselves in that country for about three centuries already; and had, through the greater part of that period, professed the Christian religion. Charlemagne entered Rome in triumph, and was crowned emperor of the Romans, with great pomp and festivity, towards the close of the eighth century.

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* Butler, Hor. Bibl. part ii. p. 85.

While such was the series of misfortunes that attended, and at length totally subverted the western empire, that of the east had to strive with difficulties of another kind, and which produced a still greater change in the political aspect of the world.

The nations by whom the successive conquests of Europe had been effected, proceeded, as we have already beheld, from different, though contiguous tracts of country, spoke different languages, and were under the command of different leaders. Yet, having originated from a like cradle, from the solitude of mountain-fastnesses, and the savage wild of precipitous scenery, nursed in the midst of snows and howling tempests, they appear to have established, in almost every state which they subdued, nearly the same legislative system; a system known by the name of the Feudal Law, and the introduction of which into Europe constitutes one of the most prominent features of European history.

It was about the middle of the period we have thus far contemplated, in the year of our Lord 568, that Mahomet was born in Arabia: and a period more auspicious to his unrivalled craft and overtowering ambition could not possibly have been produced by any concurrence of circumstances. The barbarians of the north had just completed their conquest over regular monarchy; the western empire was tottering to its foundation, while the eastern was shorn of its limits and weakened by internal oppressions. Yet neither the extent of the territories of the barbarian powers, nor their respective forms of government, were definitively settled; while, at the same time, the fury which had accompanied their progress being exhausted, they had sunk into a state of political lethargy, and no bond of union or co-operation existed between them. Were we to search for that period of the Christian era in which there was least of order, least of power, least of science, and least of intercourse in Europe, we should be compelled to pitch upon the century which immediately preceded, and that which immediately followed the commencement of the Hegira.

Mahomet flourished in the middle of this period. Deriving his immediate descent from the patriarch Abraham, through the line of Ismael, and, perhaps, eldest son of eldest son, from the commencement of the chain, he was a man of unbounded ambition, most enterprising courage, insinuating address, and instructed in all the science of his day. He beheld his own country without any fixed principles of religion, and ignorantly intermixing the rites of Judaism with the doctrines of Christianity; he beheld the professors of the Christian church engaged in perpetual disputes upon inexplicable mysteries; and excommunicating and massacreing each other, as they alternately possessed the power, upon a mere difference of recondite, or speculative points. It was the precise moment for the invention of a new creed, and he invented one accordingly. With a mastery of craft that has never been equalled, even in our own eventful age, he infused into the heterogeneous mass a charm adapted to captivate every party and every passion; and, to destroy every doubt of success, he united the power of the sword to that of the new faith, and threw open the gates of Paradise, and all the enjoyments of the beatified, to every soldier who should fall under the banners of the crescent.

Such a religion, launched forth at such a period, and aided by such auxiliaries, it was impossible to oppose by human means. It ran like lightning over the whole of Arabia, and equally subdued before it political friends and political foes. The states of Barbary were compelled to embrace it; the leaders of the Turks, the Mongol Tartars, and the Persians found it admirably adapted to their purpose, and embraced it voluntarily; all the Asiatic provinces of the eastern empire were overrun by the armies of the prophet himself, or his descendants, Abubeker and Omar: who, on succeeding to Mahomet, assumed, from respect and in reference to him, the subordinate title of Caliph, or Vicar. All Syria was invaded by the former for the express purpose, as he openly asserted, "of taking it out of the hands of the infidels;" and Jerusalem itself was captured by the latter, and rendered, shortly afterwards, one of the principal bulwarks of the Saracens, as they were soon denominated among the Christian powers.

The doctrine fundamentally inculcated by the Saracen chiefs was, that "to fight for the faith is an act of obedience to God;" and on this account they characterized their ferocious and bloody ravages by the name of *holy wars*. And having been the first to adopt this absurd and contradictory term, they laid down a model, and offered at least an apology for the crusades. And such was the success of their enterprise, that in less than a century from the commencement of the Hegira, they spread the religion of Mahomet from the Atlantic Ocean to India and Tartary, and obtained the whole, or the greater part of the temporal, as well as the spiritual power in Syria, Persia, Egypt, Africa, and Spain. Spain, indeed, has since been rescued from their bondage; but the same general success continuing, the whole of the eastern empire was overturned, and Constantinople itself taken possession of in 1453; while, in different directions, they have also pursued the same triumphant career over the kingdoms of Visapour and Golconda, in India; the islands of Cyprus, of Rhodes, and the Cyclades; and have made large territorial acquisitions in Tartary, Hungary, and Greece.

Such is a brief, but afflictive sketch of the history of the world, during what has been appropriately denominated its dark ages, throughout which it may correctly be said, that

> No light, but rather darkness visible,
> Serv'd only to discover scenes of wo,
> Regions of horror, doleful shades.

In effect, every thing concurred to introduce and establish a universal reign of ignorance and gloom: and I shall next proceed to notice more particularly a few of those causes which chiefly co-operated in producing so calamitous a result.

And the first that occurs in the course of the survey, is the sinister and contracted views, and the general repugnance to all science and polite learning that so strikingly distinguished that particular set of the barbarous tribes of the north, already noticed, by whom Europe was earliest overrun; all of whom, by a generic term, may be denominated Scandinavians. Judging of these from the only Scandinavian records which have descended to our own times, the fabulous fragments collected by Sæmond and Snorro and which are respectively called Eddas, all their arts and inventions were rude, and all their passions and pursuits violent. They had poetry, but it was altogether of the terrible kind; the whole muster-roll of their mythology consisted of not more than from forty to fifty gods and goddesses; while those of Greece amounted, in Hesiod's time, to three thousand; and in that of Augustus, to thirty thousand. The same power who, under the name of Loke, was their Ahriman, or Principle of Evil, was also, for want of a larger establishment, their Momus and their Mercury. As they had their war-songs and their war-speeches, they had also their Apollo; but, like the rest, he too was caparisoned with his javelin and his hauberk, and was a god of battles as well as of eloquence. The beatitudes of their paradise, those with which the most valiant of their heroes were rewarded after death, consisted, as we learn from the same bloody legends, in daily encounters of more than mortal fury; in the course of which the different combatants, mounted on fiery steeds, and clothed in resplendent armour, mutually wounded, and were wounded in return. Though, when the battle was over, they bathed in fountains of living water; and being instantly healed, sat down to a sumptuous banquet, at which Odin, their chief deity, presided, and passed the hours of midnight in singing war songs and drinking goblets of mead. Even the web of future events, woven by their three PARCÆ, was manufactured of strings of human entrails, the shuttles being formed of arrows dipped in gore, and the weights of the sculls of gasping warriors. It is to this fiction Mr. Gray alludes so finely, but, at the same time, so fearfully, in his Ode entitled "The Fatal Sisters."

Now the storm begins to lower,
  (Haste! the loom of hell prepare;)
Iron sleets of arrowy shower
  Hurtles in the darken'd air.

Glittering lances are the loom
  Where the web of death we strain;
Weaving many a soldier's doom,
  Orkney's wo, and Randver's bane.

See the gristly texture grow!
  'Tis of human entrails made:—
And the weights that play below—
  Each a gasping warrior's head.

Shafts for shuttles, dipp'd in gore,
  Shoot the trembling cords along.
Sword!—that once a monarch bore,
  Keep the tissue close and strong.

Horror covers all the heath:—
  Clouds of carnage blot the sun:—
Sisters! weave the web of death:—
  Sisters! cease—the work is done!

The armies of the south of Asia, however, under the banners of Mahomet, were as little disposed, at least on the first spur of their fury, to attend to the voice of literature, as those of the north. Yemen, or Happy Arabia, till the time of this accomplished impostor, was equally the seat of polite learning and of courage. It was in climate and language, as well as inelegant pursuits, the Arcadia of the eastern world. Here the genius of poetry received his birth, and was nursed into maturity with fond and incessant attention. The Persians caught the divine art from the Arabians, as the Greeks afterwards caught it from the Persians. The best pastoral poems in the world, or Casseidas, as they are called, and some of the best epic productions, are of Arabian growth. Before the era of

Mahomet, a kind of poetical academy was established in this quarter, which used to assemble, at stated times, in a town named Ocadeh; where every tribe attended its favourite poet on his recital of the piece prepared for the occasion, and supported his aspiring pretensions. Those declared by the appointed judges most excellent, were transcribed in characters of gold on Egyptian paper, and hung up in the temple of Mecca; and the seven which constitute the Moallakat, or suspended eclogues, best known in Europe, are well worthy of the celebrity they have attained.

On the appearance of Mahomet, Arabia thronged with poets of this description, and of high and justly distinguished characters; most of whom, moreover, to their honour, opposed his pretensions, and many of whom ridiculed them with a severity which he never either forgave or forgot. As he advanced, however, in success, poetry and eloquence, and scientific pursuits of every kind, became neglected and even despised, except so far as they could contribute to the promotion of his interest; the refined and elevated contests at Ocadeh were dropped, and every other passion was made to bend to the master-passion of the day. And hence, on the capture of Alexandria by the forces of Omar, the second in succession to Mahomet, the whole of its magnificent library, which had been accumulating from the time of its illustrious founder, was condemned to the flames, and served as fuel to the hot-baths for a period of six months. Amrus, the general of Omar's army was a lover of letters, and the esteem he had contracted for Philoponus, one of the most learned Alexandrians of the day, strongly inclined him to spare this invaluable treasure. He wrote, therefore, to the Caliph in its behalf, and the answer received from him is well known from Abulpharagius's history: "As to the books of which you make mention, if there be contained in them what accords with the Book of God, (meaning the Alcoran,) the Book of God is all-sufficient without them: but if there be any thing repugnant to that book, we can have no need of them. Order them, therefore, to be all destroyed."

The wild-fire of Asia, enkindled an equal wild-fire throughout Europe. Of the purity of the motive upon which the crusades were first founded there can be no doubt; but the unfortunate course they took, and the mistaken views and ferocious passions to which they gave birth, rendered them, on the part of the Christians, as hostile to the cause of science and literature, to say nothing of higher objects, as the fury of the Saracens. Every thing was forsaken and forgotten in the accomplishment of the only object with which Christendom was now pregnant; every knee bowed down before the standard of the cross; the religion of love was converted into a religion of vengeance; the motto of Mecca became that of the Vatican; to fight for the faith was here also declared to be an act of obedience to God,* and every pulse beat high with an unconquerable determination to rescue the Holy Land, and trample upon its defilers.

Hence the origin of the various military orders which form so prominent a feature in the history of this period of the world; of the Knights of Malta, or of the Hospital of St. John of Jerusalem, as they were at first called; the Knights Templars; the Teutonic Order; and the Order of St. Lazarus. Hence, too, that spirit of chivalry and romantic adventure, of tilts and tournaments; which, however, it may have laid a basis for a thousand interesting tales of wild exploit and marvellous vicissitude,* had a tendency to change the sober order of things; to convert the patriotic citizen into a champion of fortune, and to work up the temperate reality of life into a fitful and visionary frenzy.

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* The following is a part of the famous bull of Pope Gregory IX., published in 1234, in which he exhorts and commands all good Christians to assume the cross and join the expedition at that time preparing against the Holy Land. "The service to which mankind are now invited is an effectual atonement for the miscarriages of a negligent life. The discipline of a regular penance would have discouraged many offenders so much that they would have had no heart to venture upon it: but the HOLY WAR is a compendious method of discharging men from guilt, and restoring them to the divine favour. Even if they die on their march, the intention will be taken for the deed; and many in this way may be crowned without fighting."—Collier's Eccl. vol. i.

And hence, too, among those who confined their views altogether to subjects of personal devotion and still life, the extension though not the rise (for they were already in existence) of religious orders, of pilgrimages, and hermit solitudes; of vows of celibacy and fasting, of severe penance and rigour; under the preposterous idea of propitiating the Supreme Being in favour of his own cause, by directly warring with the best and warmest, the most active and most benevolent passions and instincts which he has imprinted on the human heart for the multiplication of human happiness.

The crusades were numerous, but there are only seven that are worthy of particular notice. Of these, the first was led by Godfrey of Bouillon, in 1096, and was the only one that proved really successful; and that actually rescued, though only for a few years, the whole of Palestine from the grasp of the Mahometans. The third is chiefly celebrated for the chivalrous and enthusiastic valour with which it was prosecuted under our own Richard I. in 1189; and for the generous magnanimity of Saladin, who was at that time the Saracen king of Jerusalem. The two last were headed by St. Lewis in 1248 and 1270; and are principally notorious for the piety and valour which he displayed, and the misfortunes which attended him.

The scenes of havoc and barbarity to which this infatuating system gave rise on both sides, are too shocking for narration, and too long to be recounted even if we had time. The wild desire of foreign expurgation led to a similar desire of purging the church at home; and hence the establishment of the Holy Wars led to the establishment of the Holy Inquisition;—the extirpation of infidels to the extirpation of heretics. Hence the crusaders under Baldwin, count of France, when advancing towards Palestine, in 1204, by a sudden and delirious impulse, turned aside from their attack upon the Mahometans, and attacked the Greek church in its stead, on account of its supposed heterodoxies; and took and ransacked Constantinople, instead of taking and restoring Jerusalem.

The brutal havoc which followed upon this expedition, and the destruction of all the finest statues and public monuments erected by Constantine on his founding the city, are described with much force and feeling by Nicetas the Chroniate, who was an eye-witness to the transaction, and who justly styles these crusading Vandals, *Τȣ καλȣ ανεραστοι Βαρϐαροι*:† "Barbarians insensible to the fair and beautiful." He especially laments the destruction of the inimitable figures of Hercules and Helen, which being constructed of brass, were melted down to pay the soldiers. The following is a part of his description of the latter statue, and I quote it from the translation of Mr. Harris, as a proof that Constantinople, even in the thirteenth century, had scholars not altogether destitute of literary taste.

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* Sainte-Palaye: Memoires sur l' Ancienne Chevalerie, tom. i. p. 153. et seq.

† Fabricii Biblioth. p. 412.

"What," says he, "shall I say of the beauteous Helen; of her who brought together all Greece against Troy? Does she mitigate these immitigable, these iron-hearted men? No—nothing like it could even she effect, who had before enslaved so many spectators with her beauty. Her lips," continues he, "like opening flowers, were gently parted, as if she were going to speak: and as for that graceful smile, which instantly met the beholder, and filled him with delight; those elegant curvatures of her eyebrows, and the remaining harmony of her figure; they were what no words can describe and deliver down to posterity."*

From the same demoniac spirit proceeded the infuriate crusade against the virtuous Albigeois or Albigenses in the thirteenth century; and the long and savage persecutions of the Waldenses or Vaudois, which continued almost without intermission for eighty or ninety years; and the depopulation of Spain, by an equal expulsion of Jews and Moors, when the Christian arms had once more proved successful in that country. It was during the crusade against the Albigeois (and it is the only anecdote I need advance in proof of the blind and indiscriminate fury with which these adventures were conducted) that, when a scruple arose among the crusading army as to the propriety of storming the city of Bezieres, after having made preparation for so doing in consequence of its being peopled with catholics as well as with heretics; a dexterous casuist settled the point abruptly, by exclaiming, "Kill them all: God knows which are his own."†

Independently of any other cause, therefore, it must be obvious that the internal disputes of the Christian church itself, or rather that which was called Christian, in which every nation, and almost every individual took a part, were alone sufficient to have repelled the progress of liberal and enlightened science. But beyond this, very soon after the introduction of Christianity, a fondness for the philosophy of Plato and Pythagoras prompted the more speculative ecclesiastics to investigate the mysteries of the divinity and humanity of our Saviour with too nice a curiosity; and hence the famous controversies of Praxeas, Sabellius, Arius, Nestorius, Eutyches, and various others, most of which led to very extensive proscriptions and persecutions. The schoolmen carried this itch for discussion into the most visionary subtleties of metaphysics, and acquired high-sounding titles by devoting the whole of their lives to an investigation of trifles that would disgrace a nursery. The Bishops of Rome, after having advanced themselves to the popedom or supremacy of the Church, and invested themselves with territorial power, soon began to arrogate a temporal as well as a spiritual supremacy throughout Christendom; and hence the different courts of Europe, and at times even the emperors, were in a state of perpetual hostility with them; sometimes the emperors obtaining a triumph and deposing the popes, and sometimes the popes proving successful and deposing the emperors: and hence the separation of the Greek church from that of Rome, in the middle of the ninth century, and of the English church towards the beginning of the sixteenth.

There is another cause, and it is the last I shall notice, which powerfully contributed to the night of error and ignorance, which overspread the moral horizon during the melancholy period before us; and that is, the general chaos which prevailed in the language of almost every nation of the civilized world, and the consequent want of some current medium of communication. It was a maxim of the Roman government, and of a most artful and politic character, and which, in our own day, has been closely copied by the crafty tyrant of France,* to plant its vernacular tongue wherever it planted its arms. Greece formed the only exception to this general rule; and, from its admitted superiority of taste and genius, was allowed to teach its conquerors instead of being taught by them. With this exception all the rest of Europe was Latinized in a greater or less degree. The Latinity, indeed, was of the most barbarous kind imaginable —for the dialect was, in almost every instance, a mongrel breed of Roman and aboriginal terms, with imperfect inflexions and unauthorized idioms, ready for any other change that chance might suggest or future conquest impose.

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* Harris, ii. 455, 456.

† Hist. des Troubadours, i. 193.

The barbarian conquerors of the north, however, seemed to have cared as little about their respective dialects as about their religion; and hence, in both instances, they gave and took alternately with the different nations that submitted to their yoke. Yet as fresh tides of invaders poured forward, the Latin character progressively died away; and pure Latin was at length no longer known except as the language of the learned. Even in Rome itself it ceased to be spoken at the commencement of the seventh century; and the descendants of Cæsar and Cicero, and Virgil and Horace, were incapable of reading the immortal productions of their forefathers. It had already ceased for some ages to be employed in the Greek empire; having here been supplanted by the Greek tongue itself, the prevailing language of the country, and the fashionable language of every polite Roman, shortly after the removal of the imperial court to the eastern metropolis, in the reign of Constantine.

With respect to language, Mahomet pursued the same plan as the Romans. Wherever he conquered he introduced the Alcoran, and compelled every nation to read and to understand it in his own tongue. And hence, during the seventh, eighth, and ninth centuries, the only genuine languages spoken throughout the civilized world were Greek and Arabic; both derived from a similar source, and of very early origin; and both existing without any very great degree of variation to the present hour; but neither of them employed at any time as a vernacular tongue, in the north or south, or even the west of Europe, except in Spain, where the Arabic was used during the dominion of the western caliphat in that country. In consequence of which the Latinity of the Spanish tongue is considerably tinctured with Arabic terms and phraseologies, and possesses less resemblance to its Roman origin than the Portuguese, which, as being more remote, was less affected by the Saracen invasion and conquest.

The controversies of the church, and the subtle logomachies, or word-wars of the school-men, were conducted sometimes in Greek, but far more generally in Latin. And as only the former of these tongues was known to the people of the eastern, and neither of them to those of the western empire, the laity, in general, were completely cut off from all knowledge of the little and only learning that was alternately exercised, excepting as occasionally explained to them in whatever might happen to be their vernacular tongue.

Upon the fall of the Latin language, the rude dialect that was most approved in France and Italy was the Provençal, or that made use of in Provence and its vicinity; and it was hence exclusively employed by the Troveurs or Troubadours, as they were called, Provençal poets that about the commencement of the eleventh century began to flourish very numerously; and by the complimentary and licentious gayety of their incondite rhymes, to obtain an establishment in almost every court of Europe.

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* This lecture was delivered in 1813, during the domineering power of Buonaparte.

The times, indeed, were well calculated to promote their object; for there is, perhaps, hardly a vice that can be enumerated in the whole catalogue of moral evil that did not at this era of ignorance brutalize the human heart; and even the devotees themselves consisted, for the most part, of worn-out profligates, who had no longer the power of indulging their sensual gratifications. Such, among others, was William IX., count of Poictou, who was one of the earliest Provençal Poets, and is equally celebrated for the unbridled debauchery of his earlier life, and the sanctimonious pretensions of his old age. Who at first founded an abbey for women of pleasure, and afterwards converted it into a nunnery for the chaste and the pious; and who, on being rebuked and excommunicated in the midst of his infamous career, by his own bishop, seized him by the hair, and was on the point of despatching him, but suddenly stopped short and exclaimed, "No—I have that hatred of thee, thou shalt never enter heaven through the assistance of my hand." "Nec cœlum unquam intrabis meæ manus ministerio."*

Respecting another court and people in the neighbourhood of Poictou, we are told by an excellent contemporary writer, that all the men of rank were so blinded by avarice, that it might truly be said of them in the words of Juvenal,

> Unde habeas, quærit nemo, sed oportet habere.†
> None car'd what way he gain'd, so gain were his.

"The more they discoursed about right, the greater their enormities. Those who were called justiciaries, were the head of all injustice. The sheriffs and magistrates, whose immediate duty was justice and judgment, were more atrocious than the very thieves and robbers; and were more cruel than even the cruellest of other men! The king himself, when he had leased his domains as dear as was possible, transferred them immediately to another that offered him more; and then again to another, neglecting always his former agreement; and still labouring for bargains that were greater and more profitable."‡

I have observed that in the midst of this long and gloomy night a few bright and splendid stars shot occasionally a solitary gleam athwart the horizon; and, in one or two corners of it, a radiance at times poured forth like the dawn of the morning. Several of the Arabian caliphs, as soon as the first paroxysm of their violence was exhausted, returned to that general love of literature which had immemorially been characteristic of their country. And hence, when Europe was plunged into its thickest midnight, the eastern and western caliphats, or courts of Bagdad and Cordova, (by far the most illustrious in Saracenic history) evinced a lustre and a liberality that were nowhere else to be met with, and opened asylums to the learned of every country.§ "It was then," says Abulfeda, who was himself one of the brightest gems that adorned the former court, "it was then that men of learning were esteemed luminaries that dispel darkness, lords of human kind, destitute of whom, the world becomes brutalized."‖ And from the account of the Arabic manuscripts of the escurial, drawn up y the learned Casiri, it appears, that the public libraries in Spain, when under the Arabic princes, were not fewer than seventy; a wonderful patronage of literature, when copies of books were peculiarly scarce, and enormously expensive.

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* Malmesbury, p. 96. fol. ed. 1596. † Juv. xiv. 207. ‡ Harris, ii. 515.
§ Leo Afric. De Vir. Illustr. apud Arab. Bibl. ‖ Abulphar. Dynast. p. 160.

The tie, however, between science and Islamism was unnatural, and could not continue long. The religion of Mahomet is, of itself, a choak-damp to every generous purpose of the soul; no moral harvest can flourish under it; and the few instances that it can boast of to the contrary are only exceptions to the general rule: scarce and scattered oases, or plots of verdure, that unexpectedly peep forth in the vast ocean of its sandy desert. All Mahommedan patronage of learning, therefore, has long since died away; and Arabia, which once shed so splendid a light on the rest of the world, is now sunk in darkness, while all the rest of the world is beaming with light around it. "Those vast regions," observes M. Sismondi, with a just feeling of regret, "where Islamism rules, or has ruled, are dead to all the sciences. Those rich fields of Fez and Morocco, made illustrious through five centuries by so many academies, so many universities, so many libraries, are now nothing more than deserts of burning sands, where tyrants dispute with tigers. All the laughing and fruitful coast of Mauritania, where commerce, arts, and agriculture, were raised to the highest prosperity, are at present mere retreats for pirates, who spread terror, and resign their toils for abominable indulgences, as soon as the plague returns every year to make victims of them, and to avenge offended humanity. Bagdad, formerly the seat of luxury, of power, of knowledge, is in ruins. The far-famed universities of Cufa and Bassora are closed for ever. That immense literary wealth of the Arabians, which we have only had a glimpse of, exists no more in any region where Arabians or Mussulmans govern. We are no longer to seek there for the fame of their great men, or for their writings. Whatever has been preserved is entirely in the hands of their enemies, in the convents of monks, or the libraries of European princes. Yet these extensive countries have never been conquered: it is no stranger that has plundered them of their riches; that has annihilated their population; that has destroyed their laws, their manners, and their national spirit. The poison has sprung from themselves; it has risen indigenously, and has destroyed every thing."*

Of the little genuine learning that appeared in Christendom, to temper the gross ignorance of the times, it is to the praise of the Church that by far the greater part of it, both in the eastern and western empire, was the rare boast of ecclesiastics. And it is especially to the praise of our own country, and peculiarly to that of our very ancient universities, both which can lay claim to an origin coeval with the middle period of the Anglo-Saxon octarchy, that more than half the most celebrated scholars of the times were of British birth and education. Such were Aldhelm, Bede, and Alcuin, the three great Anglo-Saxon luminaries of the eighth century, and the last of whom was the tutor and confidential friend of Charlemagne. Such was Ingulph of the eleventh century, made abbot of Croyland by William the Conqueror, and to whose history we are indebted for much that has descended to us of the era we are now surveying. Such, too, were John of Salisbury, Girald the Cambrian, and the monks Adelard and Robert of Reading; the two last of whom had travelled into Egypt and Arabia, and had studied mathematics at Cordova;

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* De la Litterature du Midi de l'Europe, tom. i. Paris. 4 tom. 1813.

and the former of whom translated Euclid out of Arabic into Latin: a clear proof, however, that Greek, the language in which Euclid himself wrote, was but little known at this time among men of letters in England. Such also was Roger Bacon, of the thirteenth century, whose knowledge of physics had so far outstripped all his contemporaries that, like Petrarch some ages afterwards, his wonderful attainments were ascribed to magic, and his holding an intercourse with the devil. And such, to close the list, was Wyckliff, in the fourteenth century, the bright and splendid phosphor of the glorious Reformation.

These, and as many more, had I time to enumerate them, were furnished from the church. Nor has the laity any reason to be ashamed of its contributions: Sir John Fortescue brilliantly adorned the fifteenth century, Sir John Mandeville the fourteenth; which was also enlightened by the combined and powerful talents of Gower and Chaucer, of Dante, Petrarch, and Boccace. Henry I. and Henry II. are nearly equally celebrated in the twelfth century, for their patronage of learning and learned men, and especially for their promoting the purest taste in Gothic architecture; during whose reigns the most sumptuous and admired of our national buildings of this kind were erected. The eleventh century is peculiarly signalized by the splendid talents and learning of Egitha, queen of Edward the Confessor, who, in the language of Ingulph, was equally admired for her beauty, her literary accomplishments, and her virtue. Let us ascend a century higher, and close the whole with the sacred name of Alfred; a name no Englishman ought to pronounce without homage: equally tried and equally triumphant in adversity and prosperity; as a legislator and philosopher; as a soldier and politician; a king and a Christian; the pride of princes; the flower of history; and the delight of mankind.

We have thus rapidly travelled over a wide and dreary desert, that, like the sandy wastes of Africa, to which we have just referred, has seldom been found refreshed by spots of verdure, or embellished by plants that should naturally belong to the country:—and what is the upshot of the whole?—the moral that the survey inculcates?—Distinctly this;—a moral of the utmost moment, and imprinted on every step we have trodden; that ignorance is ever associated with wretchedness and vice, and knowledge with happiness and virtue. These connexions are indissoluble; they are enwoven in the very texture of things, and constitute the only substantial difference between man and man. For, if we except these distinctions, "all men," observes one of the most enlightened writers of this dark period, to whom I have already adverted, John of Salisbury, who was contemporary with Stephen and Henry II., and whose classical Latin I shall put into literal English, "all men throughout the world proceed from a like beginning, consist of and are nourished by like elements, drawn from the same principle, the same vital breath, enjoy the same care of heaven, pass through life alike, and alike die."*

To which I shall only add, that, as Christianity is the most perfect kind of knowledge, it must essentially produce the most perfect kind of happiness. It is the golden everlasting chain let down from heaven to earth; the ladder that appeared to the patriarch in his dream: when he beheld Jehovah at his top, and the angels of God ascending and descending with messages of grace to mankind.

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* De Nugis Curialium; Harris, ii. 525.

LECTURE XIII.

ON THE REVIVAL OF LITERATURE.

In the last lecture, we continued our progress through that general history of science and literature which we had commenced in the lecture that preceded it; and having, in the first of these studies, brought down the subject from the most celebrated times of Athens and Rome to the decline of the Roman empire; we waded, in the second, through the barren and cheerless period of the dark or middle ages, extending from the fall of Rome before the barbarous arms of the Goths, in the fifth century, to the fall of Constantinople before the no less barbarous arms of the Turks, in the fifteenth century;—exploring our way as well as we were able, by the occasional guidance of a few transitory and uncertain beacons, amidst the desolate realms of mental darkness and chaos by which we were surrounded, till we reached the auspicious hour in which the voice of the Almighty once more exclaimed throughout the dead and dreary waste, "LET THERE BE LIGHT!—AND THERE WAS LIGHT."

The period of the revival of letters in Christendom is, in many respects, one of the most brilliant eras in human history. Without the intervention of a miracle we behold a flood at noon-day bursting all at once over every quarter of the horizon, and dissipating the darkness of a thousand years; we behold mankind in almost every quarter of Europe, from the Carpathian mountains to the Pillars of Hercules, from the Tiber to the Vistula, waking as from a profound sleep to a life of activity and bold adventure; ignorance falling prostrate before advancing knowledge; brutality and barbarism giving way to science and polite letters; vice and anarchy to order and moral conduct; and idolatry, hypocrisy, and superstition, to the pure simplicity of Christian truth. Hence, in some places, we trace the fall of feudal slavery and vassalage—in others, of popish tyranny and imposition—and in every place, a juster sense of relative duties and of the real dignity of man. Hence, the origin of those important inventions, paper and clock-making, printing, telescopes, and gunpowder; and hence, too, the first insight into the modern doctrine of the circulation of the blood; and the wonderful discoveries of the mariner's compass, the sphericity of the earth's surface, and the revolution of the planets around the sun. Hence Portugal, with a bold and adventurous canvass, doubled the Cape of Good Hope, and realized a maritime passage to India; Spain explored and established herself in a new world; and England, in the person of the intrepid Drake, for the first time circumnavigated the globe; while Galileo, by the marvellous invention and application of his telescope, unfolded to us not another world alone, but systems of worlds upon worlds in endless succession throughout the heavens; all which astonishing series of splendid facts and transactions, together with various others of nearly equal importance, crowd upon each other within the short period to which we are now confining our attention, extending from the beginning of the fourteenth to about the middle of the sixteenth century. The heart of man seemed to beat with a new and more vigorous pulsation, and all the energies of the soul to be roused to the proudest darings of adventure.

In contemplating the causes of that wonderful change in the character and pursuits of civilized Europe, which this extraordinary combination of circumstances indicates, the following may, perhaps, be regarded as among the principal.

First, the natural spring or elasticity of the human mind, by means of which, though it may for a time be borne down by a weight of ignorance or oppression, it at length rouses from its turpitude, resumes its innate energy, and shakes off the vampire burthen with a recoil proportioned to the pressure that subdued or stifled it.

Secondly, he sudden flight and dispersion of the best and almost the only literary characters of the age from the walls of Constantinople, upon the capture of this elegant and renowned city by the Turks, under the victorious banners of Mahomet II.

Thirdly, the taste for literature which, at this very period, was reviving in many of the Italian states, and more particularly at Florence under the illustrious family of the Medici; and especially the election of the celebrated Giovanni de' Medici to the pontificate, under the name of Leo X.

Fourthly, the facility afforded by the art of printing, discovered at the very period of the fall of Constantinople, to the diffusion of useful and polite learning in every direction.

And, fifthly, and, perhaps, chiefly, the general attention and spirit of inquiry, which were excited throughout every country in Christendom, by the grand and eventful drama of the Reformation at this time exhibiting in Germany.

Let us attend to each of these causes in the order in which I have stated them.

I. Vice and ignorance are the necessary companions of each other: such is the immutable law of nature; and we can no more reverse it, than we can reverse the stars in their courses; and nothing can exceed the extreme to which both were carried during the period of the fourteenth and fifteenth centuries; and to which the whole texture of the feudal system, and the abominations of the Vatican tyranny, equally contributed.

When the barbarous and intermixed tribes of Goths, Huns, and Vandals, poured down in successive streams from the north, and overran the different provinces of the Roman empire, the conquered lands distributed by lot, and thence called *allotted* or *allodial*, were held in entire sovereignty by the different chieftains, without any other obligation existing between them than that of uniting on great occasions to defend the community. Additional tribes still succeeded:—wider tracks of country were subdued, and many individuals occupied land to a very considerable extent: while the king or captain-general, who led on his respective tribes to conquest, naturally acquired by far the largest portion of territory as his own share. These lands he found it convenient, in order to maintain his influence, to divide among his principal followers, merely subjecting them, for the grant, to certain aids and military services.

His example was imitated by his courtiers, who distributed, under similar conditions, portions of their estates to their dependants. Thus a feudal kingdom became a military establishment, and had the appearance of a victorious army, subordinate to command, and encamped under its officers in different parts of the country; every captain or baron considering himself independent of his sovereign, except during a period of national war. Possessed of wide tracts of country, and residing at a distance from the capital, they erected strong and gloomy fortresses in places of difficult access; and not only oppressed the people, and slighted whatever happened to be the civil magistracy of the state, but were often in a condition to set the authority of the crown itself at defiance.

As the tenure by which the lands were held was military; as there was no art or science to occupy the mind; as reading was seldom cultivated, and writing a still rarer accomplishment; every landed proprietor was a mere soldier; and being expert and strong by the daily use of arms, was eager for an opportunity of showing his prowess. Nor was such opportunity ever wanting; for, when not employed in expeditions against a public enemy, he was commonly engaged in some petty enterprise at home, prompted by pride, avarice, or revenge. Hence *feuds*, as indeed the term itself imports, were the peculiar characteristic of *feudal* power; vice and idleness were perpetually engendering animosities; gross ignorance disabled the different parties from adjusting them by the address of argument and fair reason; brutal obstinacy rendered them hereditary; and the son who succeeded to his father's estate succeeded also to his quarrels.

While such was the ready aid which the political system of the times administered to the gloomy reign of mental darkness and disorder, the gross misconduct of the church was still more instrumental in promoting the same direful effect. Although nothing is more clear than that, through the whole of this desolate period, God never left himself without a witness of the truth, the purity, and the power of the genuine doctrines of Christianity; although nothing is more clear than that, even in the deepest midnight of this desolate period, a few honest, zealous, and conscientious ecclesiastics, and even laymen, are to be met with who sedulously and manfully opposed themselves to the general corruption of their contemporaries; it is equally clear, that the great mass of the priesthood assumed the sacred habit for the mere purpose of indulging more effectually in the worst and most licentious passions and appetites; and surpassed all the rest of the community in the irregularity and scandal of their lives. Many of them were professed infidels, and exclaimed openly to each other, "*Quantas divitias nobis peperit hæc Christi fabula!*"—"What wealth does this fiction of Christ obtain for us!" a sentiment generally ascribed to the free-thinking genius of Leo X., but which, whether ever uttered by him or not, was in frequent use long before this era; while nearly all concurred in the well-known motto that "ignorance is the mother of devotion."

In truth, it requires no ordinary stock of temper to wade through the scenes of abominable filth and bare-faced hypocrisy which characterized the *holy fathers* of the church, as they were impiously denominated, at the period immediately before us. Crusades, indeed, had long been in use for the extirpation of infidelity, and there were occasional triumphs of the Cross over the Crescent; but, like most other pretensions to ecclesiastical zeal and devotion, even these had for the most part been perverted to the sinister purposes of avarice, temporal authority, or revenge; while plenary indulgences and remissions of sin, for given periods of time, or in other words, formal licenses to live a life of unrestrained debauchery, and gratify every libidinous appetite and inclination for the term specified, had, during the existence of many crusades, been openly granted at the Vatican, as well as distributed for this purpose by its commissaries, all over Europe, to every one who would either consent to join the sacred standard in person or hire a substitute to fight for him. And similar indulgences were continued after their cessation, and were notoriously bought and sold at a settled or market-price.

This was strikingly exemplified during the papacy of Urban II. in the year 1100; while it is admitted by the warmest advocates of the Vatican that the famous fabric of St. Peter's church at Rome was paid for under Leo X. out of the same resources; which they venture to urge, indeed, in justification of the measure;* as though crimes could change their nature by the end for which they are perpetrated.

One of the fittest instruments for this traffic of abomination was the notorious Dominican inquisitor John Tetzel, who, true to his own trade, led so abandoned a life of debauchery that he was at length condemned to death by the Emperor Maximilian for the crime of adultery, accompanied with very atrocious circumstances; and was saved from undergoing the punishment with great difficulty. He had the effrontery to boast that he had saved more souls from hell by his indulgences than ever St. Peter had converted to Christianity by his preaching.

This juggler in iniquity, however, was at times himself out-juggled by others; and the following instance of his being over-reached, as gravely related by Sechendorf, will show that the mummery of his trading was as ridiculously absurd as it was grossly nefarious. A man of some rank at Leipsic, who was disgusted with his villany, and determined to be even with him, applied to him for information whether he could grant absolution for a sin of a particular kind intended to be perpetrated, but to be kept a secret till the time. Tetzel replied boldly that he could readily do so, provided the payment were made equal to it. The bargain was instantly struck, the money paid down; and the diploma of absolution signed, sealed and delivered in due form. The purchaser, thus empowered, waited quietly till Tetzel, having collected from Leipsic and its neighbourhood all the money he was able to lay hold of, set off for his home richly freighted. The man of absolution followed him right speedily; overtook him on the road; plundered him of the whole of his fraudulent gain, and, having beaten him soundly at the same time over the shoulders, produced his patent of absolution, avowed that this was the sin he had purchased leave to commit, and sent him back to Leipsic to tell his own story.

If we turn immediately to the Vatican itself, and observe the personal conduct of the direct successors to the chair of St. Peter, and of the sacred college by which they were surrounded, what is the picture which is unfolded to us? We behold pope fighting against pope, cardinals, in a multiplicity of instances, against cardinals;† the former occasionally deposed, and the latter still more frequently strangled. We behold Leo X., when only an infant of seven years old, made abbot of the rich benefice of Fonte-dolce; a few years afterward holding not less than twenty benefices equally rich and valuable at the same time; and nominated to the grave and venerable college of cardinals at the age of thirteen. We behold Alexander VI., a near predecessor of Leo X., living incestuously with his own daughter, the loose but beautiful and accomplished Lucretia Borgia, a common prostitute to her father and her two brothers; and we behold one of the brothers assassinating the other, and shortly afterward her legitimate husband, in the precincts of the apostolic palace, and upon the threshold of St. Peter's church, from a jealousy of their superior pretensions to her favour.‡ While, to close the whole, for it is disgusting to wade in such a slough of moral filth, we behold the council of Lateran inveighing with all its authority against the scandalous lives of many of its own ministers, who, not satisfied with living in a state of concubinage themselves, consented to receive the wages of iniquity, and sell licenses to the laity for the grant of a like indulgence.[*]

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* See Dupin. book ii. ch. i.; as also Roscoe's Life of Leo X. vol. iii. p. 150.

† Roscoe, vol. ii. p. 104.

‡ Id. vol. i. Subjoined Dissertation, pp. 8—11.

But it may, perhaps, be said, that in these instances the soft enervating power of an Italian climate, and the licentious habits which so peculiarly characterized the decline of the Roman empire, and which to the period before us had never been altogether eradicated, laid a foundation for vices which would not otherwise have been exhibited. Let us then direct our attention to a climate of another kind; let us turn to the hardy and proverbially virtuous inhabitants of Scotland, and proverbially virtuous, too, from the very nature of the climate itself: what was the effect of ignorance and papal superstition amidst the corruption of the fourteenth and fifteenth centuries upon the physical temperance and chastity of the Highlands? The following is Dr. M'Crie's account in his life of John Knox, and which he supports by sufficient authorities:—

"The corruptions by which the Christian religion was universally depraved, before the Reformation, had grown to a greater height in Scotland than in any other nation within the pale of the western church. Superstition, and religious imposture, in their grossest forms, gained an easy admission among a rude and ignorant people. By means of these the clergy attained to an exorbitant degree of opulence and power; which were accompanied, as they always have been, with the corruption of their order, and of the whole system of religion. The full half of the wealth of the nation belonged to the clergy; and the greater part of this was in the hands of a few of their number, who had the command of the whole body. Avarice, ambition, and the love of secular pomp, reigned among the superior orders. Bishops and abbots rivalled the first nobility in magnificence, and preceded them in honours. They were privy-councillors and lords of session as well as of parliament, and had long engrossed the principal officers of state. A vacant bishopric or abbacy called forth powerful competitors, who contended for it as a principality or petty kingdom: it was obtained by similar arts, and not unfrequently taken possession of by the same weapons. Inferior benefices were openly put to sale or bestowed on the illiterate and unworthy ministers of courtiers; on dice players, strolling bards, and bastards of bishops.—There was not such a thing known as for a bishop to preach:—the practice was even gone into desuetude among all the secular clergy, and wholly devolved on the mendicant monks, who employed it for the most mercenary purposes.

"The lives of the clergy, exempted from secular jurisdiction, and corrupted by wealth and idleness, were become a scandal to religion, and an outrage on decency. While they professed chastity, and prohibited, under the severest penalties, any of the ecclesiastical order from contracting lawful wedlock, the bishops set the example of the most shameless profligacy before the inferior clergy; avowedly kept their harlots; provided their natural sons with benefices, and gave their daughters in marriage to the sons of the nobility and principal gentry; many of whom were so mean as to contaminate the blood of their families by such base alliances for the sake of the rich dowries which they brought.

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[*] Quia vero in quibusdam regionibus nonnulli jurisdictionem habentes, pecuniarios quæstus a concubinariis percipere non erubescunt, patientes eos in tali fœditate sordescere, sub pœna maledictionis æternæ præcipimus, ne deinceps sub pacto, compositione aut spe alterius quæstus, talia quovis modo tolerent, aut dissimulent.—S. S. Concil. tom. xiv. p. 302.

"Through the blind devotion and munificence of princes and nobles, monasteries, those nurseries of superstition and idleness, had greatly multiplied in the nation; and though they had universally degenerated, and were notoriously become the haunts of lewdness and debauchery, it was deemed impious and sacrilegious to reduce their number, abridge their privileges, or alienate their funds.

"The ignorance of the clergy respecting religion was as gross as the dissoluteness of their morals. Even bishops were not ashamed to confess that they were unacquainted with the canon of their faith, and had never read any part of the sacred Scriptures, except what they met with in their missals."*

It is not, then, to be wondered at, that, under so repugnant and scandalizing a state of things, notwithstanding the darkness and deformity of the times, mankind should in every part of Europe be growing ripe for a change, and, that the still small voice of the conscientious few, who exposed and resisted the corruption around them, should be working with a wholesome ferment amidst the general mass; that that elastic power of the human mind, which, in our own day, we have seen in Spain, in Russia, in Germany, and may yet, perhaps, see in France,† rising with indignant recoil against the domestic or foreign tyranny by which it had been long bowed down, should be swelling, and labouring, and maturing to the same effect, in the case before us; co-operating with the intrepid voice of Wyckliff in our own country, and with the ashes of Huss and Jeremy of Prague, that were not in vain sprinkled over the guilty soil of Switzerland, and effecting that important revolution, which reason, religion, and common sense, equally vilified and insulted, equally called aloud for and sanctioned.

II. At this very period, in the year of our own era 1445, Constantinople, the delight and glory of Constantine, who founded and named it after his own name; the metropolis of the eastern empire; the rival of ancient Rome; the seat of elegance, refinement, and luxury; the asylum of science upon its banishment from the west of Europe, by the savage incursions of the northern tribes; where the language of Homer, and Herodotus, and Plato, and Aristotle, and Sophocles, and Demosthenes, was still spoken as the common tongue, and their writings still studied and idolized,—fell prostrate before the haughty banners of the Turks, the most enterprising, but, at the same time, the rudest and most barbarous of all the Saracen powers. All Europe trembled at the intelligence, and an utter extinction was predicted to the little learning and virtue which were now beginning to glimmer in the midst of the general darkness.

The fear, however, was without foundation; and the very event which was apprehended, and with much reason, to be most fatal to the cause of true religion and science, proved most propitious to their promotion. Thus inscrutable are the ways of Providence, in a thousand instances, to the calculations of man, and thus triumphant the Divine government when it seems most trampled upon. The career of the Crescent, though it overran the most delightful provinces of the Greek empire, and spread to an enormous extent towards the East, did not, except in a few instances, advance farther in a north-western direction than the borders of Transylvania and Hungary; while Italy, whose most renowned scholars had found an asylum at Constantinople, upon its general ravage by the Goths, now offered, in return, to the scholars of Constantinople an asylum from Turkish fury and oppression; thus enabling the elegant and accomplished Greeks, a second time, to give letters to Europe; at this period to the modern world, as they had done two thousand years before to the ancient.

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* Life of John Knox, pp. 14—28.

† The prediction is fulfilled. The passage was delivered, during the usurpation of Napoleon, in 1813.

Several of the Italian governments had, indeed, for half a century begun to feel the importance of literature and science, and consequently to offer protection and patronage to scholars of every description. Florence, Naples, and Ferrara are particularly entitled to this eulogy; and, in a somewhat inferior degree, Venice, Urbino, Mantua, and Milan. It was a growing spirit, and a growing patronage; till, at length, upon the introduction of Giovanni de' Medici, into the college of cardinals, in 1490, and more especially upon his election to the pontificate, in 1513, Rome surpassed every other state in the splendid and extensive encouragement it afforded to wit and wisdom of every kind, (with the lamentable exception of that it ought chiefly to have prized,) but especially to classical literature and the fine arts.

III. The Latin tongue was, at this time, so far revived as to become cultivated and understood in all its elegancies; and Dante, Petrarch, Boccacio, Trissino, Sanazzaro, Ariosto, and a bright galaxy of other writers, too extensive to be enumerated, had progressively given a character and almost a mature polish to modern Italian. But a knowledge of Greek, the master-tongue of the world, of Attic eloquence and refinement, was but very limited and imperfect, amidst the best scholars of the day; and hence, as I have already observed, the fugitive scholars of Constantinople were hailed in almost every part of Italy, and especially by the splendid and illustrious family of the Medici, first of Florence, and afterwards at Rome. The directors, indeed, of the early studies of Leo X., or Giovanni de' Medici, as he was then called, were partly drawn from this well-spring of genuine taste and genius; Demetrius Chalcondyles, and Petrus Ægineta, both native Greeks, being among the more prominent of his tutors. While, in the very first year of his election to the pontificate, he founded a Greek institute of great extent and magnificence in the centre of the apostolic see; gave a general invitation to young and noble Greeks to quit their country, and take up their residence under his protection; purchased for the accommodation of these illustrious strangers the noble palace of the Cardinal of Sion, on the Esquilian hill, which he splendidly endowed as an academy; and, as far as their talents or education fitted them for the purpose, inducted them into the Roman church, and conferred upon them some of its highest dignities and distinctions.

IV. Nothing could occur more auspiciously to the zeal and splendour with which this munificent and sumptuous pontiff was prosecuting the revival of literature than the invention of PRINTING;—that wonderful discovery which has since effected, and which is so well calculated to effect, the most important revolutions among mankind: the noblest art of man, next to the invention of letters; the winged commerce of the mind; the impregnable breast plate of freedom. We may fairly call it an *invention*, even at the period here adverted to, since, though the same art, as well in the form of stereotype or wooden blocks, and of moveable type, had at this time been in use in China ever since the close of the ninth century, and was encouraged by the patronage of the Emperor Teen Foh,* there is not the smallest ground for supposing, as there is in the case of the mariner's compass, that it was introduced into Europe from any communication with the Chinese empire. Strasburg has the honour of having given birth to this invention in the middle of the fifteenth century, at the very period when Constantinople fell prostrate before the standard of the Crescent. It was for some time kept a profound secret; but it was an art of far too much importance to remain concealed long; and was soon eagerly laid hold of by a variety of spirited and noble Italians, whom the fashion and ardour of the times had stimulated to try their respective powers in the generous contest for literary fame and distinction; and applied, upon an extensive scale, to a publication of correct and almost immaculate editions of the best Greek, Roman, and vernacular authors.

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* Morrison's Philological View of China, p. 27.

Among this excellent group, worthy of all praise and immortality, stands first in order of time, and foremost in that of merit, the well-known name of Aldo Manuzio, or Aldus Manutius Bassianus, the intimate friend of Erasmus, born at Bassiano, a village within the Roman territory, in the year 1447: he established his printing school at Venice; invited all the scholars of the age to his assistance; and, in 1494, produced, as the first fruits of the Aldine press, the first Greek poem or Greek book that ever appeared in print, the Hero and Leander of Musæus; which was followed, not many years afterwards, by an accurate edition of the entire works of Plato, at that time the most popular of all the Greek philosophers; introduced by an elegant copy of Greek verses composed by Marcus Musurus, one of the most learned Greeks of the day, who had carefully superintended the press, and justly complimentary to the talents and princely munificence of the head of the church; who, with a singular coincidence of facts, was at that very moment addressing a letter to Musurus, requesting his assistance in the formation of his Greek seminary at Rome. I need not add, that to Musurus, to Aldo, to Agostino Chisi, who also founded, and at Rome itself, a printing establishment of great extent and celebrity, to scholars and artists of every description and country, his patronage, his high approbation, and his pecuniary aid, were dealt out to an extent, and with a liberality, that no other age has ever witnessed either before or since.

Nor did he confine his attention to a restoration of the Greek and Roman languages, or an improvement of his vernacular tongue. Under his auspices a study of the oriental dialects, so necessary to a perfect knowledge of the sacred writings, now first begun to engage the attention of the learned. He invited ecclesiastics from Syria, Ethiopia, and other eastern countries. In order to carry this important object into due effect, he established a Syriac chair in the university of Bologna, and appointed the celebrated canon Teseo Ambrogio to be the first professor, who is said to have been acquainted with eighteen different languages, and to have delivered his instructions in the Syriac and Chaldee tongues with the fluency of a native. He patronized the Psalter of Agostino Giustiniani, published at Genoa in 1516, in four different languages; personally perused and superintended, as long as he lived, Pagnini's translation of the Bible from the original Hebrew; and, to sum up the whole, gave every encouragement to that master-piece of learning and labour, the Complutensian polyglot of Cardinal Ximenes; which, with the strictest justice and propriety, was dedicated to him upon its completion: so that, with perhaps a single exception, we may adopt the following elegant eulogy of Mr. Pope:

> "But see, each Muse in Leo's golden days
> Starts from her trance, and trims her wither'd bays;
> ROME's ancient genius, o'er its ruins spread,
> Shakes off the dust, and rears her reverend head.
> Then sculpture and her sister-arts revive;
> Stones leaped to form, and rocks began to live;
> With sweeter notes each rising temple rung;
> A RAPHAEL painted, and a VIDA sung."

The exception in these verses, to which I refer, is the intimation that the service of the temple was now more pure and appropriate. For the general history of Leo's pontificate, as well domestic as public, abundantly shows that pure, undefiled religion was a very subordinate concern in the estimate of this accomplished high priest. He is accused, indeed, of having been a direct infidel; and of having invented the blasphemous exclamation I have already noticed, "What wealth does this fiction of Christ obtain for us!" I cannot affirm that he never repeated this burst of blasphemy, but it is well known to have been in use long before his day. Nor ought it to be forgotten that it was Leo X. who excited Vida, as he himself tells us, to write his Christiad, upon the simple unadulterated language of the Bible, with an utter omission, for the first time, of all that absurd introduction of heathen mythology into its sacred mysteries, in which Sannazaro, Torquato Tasso, and even Camoens, have so largely indulged: an omission, which it is difficult to conceive that an infidel, whether secret or open, could ever have suggested or ever allowed. Yet the measures he too often pursued, and especially the sale of indulgences, which we have already touched upon, and shall once more have to notice presently, and the profligate characters whom he employed, or knowingly allowed to be employed, as his delegates in negociating their sale, as well as in effecting various other objects, more particularly that abandoned wretch, John Tetzel, some of whose exploits have already passed before us, give abundant proof that he was satisfied with the pomp and splendour of the church, and had no religious principle at heart. He had a love for its ceremonials, as they gratified his leading propensity of unbounded splendour and magnificence. And as the externals of the church displayed to him a wider field for an encouragement of learning, and criticism, and translations; of founding professorships for foreign tongues; of hunting up sacred manuscripts and records from the East; and for building churches and palaces of unrivalled grandeur and beauty, than any thing else could open to him; he was eager and even profligate in following up such pursuits, and adding them to his earnest desires to obtain the finest poetry, and music, and eloquence, and sculpture of his own or any former age: but of genuine, vital religion, the spiritualized breathings of Gregory I., we have no proofs whatever in any part of the pontificate of Leo X.

In few words, such was the general taste for learning and science that characterized the immediate period before us, that there was scarcely an Italian state which had not its university, its printing press, numerous literary institutions and poets, historians, grammarians, architects, and musicians of high and deserved celebrity; while the sacred flame, spreading in every direction, arts, literature, and a bold and adventurous spirit of philosophical research, foreign travel, and commercial speculation, blazed forth in every direction, from the Po to the Elbe, from the Thames to the Tagus.

V. I have said that ignorance and vice are inseparable associates. But is the converse of this proposition equally true? We have now seen mankind advancing in the path of knowledge—are knowledge and virtue equally inseparable? I have a pride in answering this question; and dare appeal to every page in the history of the times before us for the truth of its affirmative.

From the first moment that the dawn of literature began to glimmer in the horizon of Italy, where, as I have already observed, it shot forth its earliest twinklings, it pointed, as with the finger of reprobation, to the abominable abuses of the church, and stung to the quick in the satires and brilliant wit of Dante, Petrarch, and Boccacio; the first of whom, in his incomparable "Divina Commedia," assigned, without scruple, situations and torments in hell to not less than three or four of the most debauched or most despotic of the popes, apportioning their sufferings to their respective vices and degrees of tyranny while on earth;* the second of whom characterizes the papal court in one of his sonnets, by the name of Babylon, and declares that he has quitted it for ever, as a place equally deprived of virtue and of shame, the seat of misery, and the mother of error; and the last of whom made it his direct object, in his very popular and entertaining work, the "Decamerone," to expose the whole priesthood to ridicule and contempt; his entire argument consisting of the debaucheries of the religious of both sexes. As learning advanced, these attacks became more frequent; and as the art of printing established itself, the assaults of the more celebrated writers, of Poggio, Burchiello, Pulci, and Franco, were published at Antwerp, Leipsic, and in other parts of the Continent, as well as in France and Italy; till at length the church, becoming sensible of her danger, and, at the same time, equally sensible of her utter inability to repel the shafts that were levelled against her, attempted, like the grand tyrant of the present day,† to suppress the voice of truth and of public feeling by severe denunciations and punishments; and hence, in the tenth session of the Council of Lateran, immediately before the elevation of Leo X. to the pontificate, decreed, that no one under the penalty of excommunication should dare to publish any new work without the approbation either of the ordinary jurisdiction of the place, or of the holy inquisition.

Such denunciations, however, had by this time, in a very considerable degree, lost their authority, and even Leo himself, in the zenith of his potency and popularity, and in many respects not popular without reason, fell a sacrifice to practices which, however supported by custom, are equally repugnant to religion and common sense.

I have already described a part, though comparatively but a small part, of the enormous expenses into which the prodigal but refined magnificence of this genuine descendant of the Medici was annually plunging him. His taste for luxury was unbounded; his foreign diplomacy was conducted upon a scale of still greater splendour than his domestic court, or his literary establishments; while he was at the same time in the regular disbursement of almost incalculable sums for embellishing the Vatican, and augmenting its library with manuscripts collected from every quarter of the globe, and in completing the immense fabric of St. Peter's church, commenced by his predecessor Julius II. The vast revenues of the apostolic see, both temporal and spiritual, were incompetent, by their ordinary channels, to these wide and multifarious demands: he had exhausted the pontifical treasury; and, following an example which had too often been furnished by his predecessors, he fell into the absurdity of granting a sale of indulgences for its repletion.

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* Those whom he has more especially signalized by their sufferings in the infernal regions, are Pope Nicholas III., whom the poet finds tortured in the Gulf of Simony, Pope Boniface VIII., and Pope Clement V. The confession of Nicholas III. is peculiarly striking, who at first mistook Dante, in his transitory visit, for his own successor in the papal chair, whom he had been long expecting:—

> "Poi sospirando, e con voce di pianto
> Mi disse: Dunque che a me richiedi?
> Se di saper ch'io sia ti col cotanto
> Che tu abbi pero la ripa scorsa,
> Sappi, ch'io FUI VESTITO DEL GRAN MANTO," &c.
>
> Inferno, canto xix.

† Napoleon Buonaparte: the day alluded to being, as already observed, 1813.

Indulgences were a ticklish subject in the worst of times;* and in the times before us the more conscientious and enlightened churchmen were as little disposed to endure them as the laity. In this respect, the feelings of Erasmus, Melancthon, Bucer, and Luther, coincided; but the three former, being of mild, conciliatory tempers, remained quiet; while the natural hardihood and high spirits of the last incited him to open resistance. Our time will not allow us to enter into the dispute: the high-pontiff, whose natural disposition, it must be admitted, was also conciliatory, stood aloof from it as long as it was possible; but his delegates were, for the most part, incautious, violent, and overbearing; and Luther, in almost every instance, had the advantage of them, as much in dexterity of management as in soundness of cause. The controversy grew wider and warmer; one step led on to another; and the inflexible champion, who at first only intended to controvert the infallibility of the POPE, at length found himself compelled to controvert that of the CHURCH; and finally, to regard the high-pontiff as ANTI-CHRIST. The contention had now reached its extreme point, and the only alternative which remained to the intrepid monk of St. Augustine was retraction or excommunication. He halted not between two opinions, but boldly braved the latter; and addressing himself to the Emperor Charles V., who presided at the august and crowded diet before which he was summoned; "As your Majesty," said he, "and the sovereigns now present, require a simple answer, I reply thus, without vehemence or evasion: Unless I be convinced, by the testimony of Scripture, or of plain reason, (for on the authorities of the Pope and Councils alone, I cannot rely, since it appears they have frequently erred and contradicted each other,) and unless my conscience be subdued by the word of God, I neither can nor will retract any thing; seeing that to act against my own conscience is neither safe nor honest." After which he added, in his native German, the preceding having been spoken in Latin, "Here I take my stand. I cannot act otherwise. God be my help. Amen."

Hie stehe ich. Ich kan nicht anders. Gott helff min. Amen.

With this noble protest was laid the key-stone of the REFORMATION: the pontifical hierarchy shook to its centre; and the great cause of truth and regenerate religion, which had already made its appearance in Switzerland, under the honest-hearted and undaunted Ulric Zwingle, spread with electric speed over a considerable portion of Germany; and, within the space of four years, extended itself from Hungary and Bohemia to France and Great Britain. That, in the infancy of its progress, various enormities were perpetrated, and that even the conduct of its mighty leader was, in this respect, not at all times irreproachable, must be equally admitted and lamented; but they were enormities merely incidental to the inexperienced season of infancy, and which disappeared as the cause ripened into mature age; while, whatever may have been the occasional violence of Martin Luther, "all parties must unite in admiring and venerating the man who, undaunted and alone, could stand before such an assembly, and vindicate with unshaken courage, what he conceived to be the cause of religion, of liberty, and of truth; fearless of any reproaches but those of his own conscience, or of any disapprobation but that of his God."*

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* Yet the council of Trent has long since established their use as a part of wholesome discipline, by formally decreeing that "the power to grant indulgences by Jesus Christ, and the use of them, is beneficial to salvation."

Such is a brief glance at the wonderful periods that anticipated and have introduced our own unrivalled era. Long and doubtful was the conflict between intellectual life and death; glimmering slowly succeeding to glimmering; light still struggling with suffocating darkness, not for weeks, or months, or years, but for centuries upon centuries, before the day-spring became manifest. Yet, no sooner had the long-delayed and long-wished-for fulness of the times at length arrived, than the marble tomb of ignorance and error gave way, as it were, of a sudden; a thousand glorious events and magnificent discoveries thronged upon each other with pressing haste, to behold and congratulate the mighty birth, the new creation of which they were the harbingers; when, with a steady and triumphant step, the peerless form of human intellect rose erect; and throwing off from its freshening limbs the death-shade and the grave-clothes by which it was enshrouded, ascended to the glorious resurrection of that noontide lustre which irradiates the horizon of our own day, rejoicing like a giant to run his race.

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* Roscoe's Life of Leo X. vol. iv. p. 36.

SERIES III.

LECTURE I.

ON MATERIALISM AND IMMATERIALISM.

It is one part of science, and not the least important, though the lowest and most elementary, to become duly acquainted with the nature and extent of our ignorance upon whatever subject we propose to investigate ;* and it is probably for want of a proper attention to this branch of study that we meet with so many crude and confident theories upon questions that the utmost wit or wisdom of man is utterly incapable of elucidating. The rude uninstructed peasant, or ignorant pretender, believes that he understands every thing before him ; the experienced philosopher knows that he understands nothing. It was so formerly in Greece, and will be so in every age and country : while the sophists of Athens asserted their pretensions to universal knowledge, Socrates, in opposition to them, was daily affirming that the only thing he knew to a certainty was his own ignorance. The shallow Indian sage, as soon as he had made the important discovery that the world was supported by an elephant, and the elephant by a tortoise, felt the most perfect complacency in the solution he was now prepared to give to the question, by what means is the world supported in empty space ? And it is justly observed by Mr. Barrow, that the chief reason why the Chinese are so far behind Europeans in the fine arts and higher branches of science, as painting, for example, and geometry, is the consummate vanity they possess, which induces them to look with contempt upon the real knowledge of every other nation.

The subjects we have thus far chiefly discussed, though others branching out from them have been glanced at as well, have related to the principle and properties of matter, both under an unorganized and under an organic modification : and although I have endeavoured to do my utmost to put you in possession of the clearest and most valuable facts which are known upon these subjects, I am much afraid it is to little more than to this first and initial branch of science that any instructions I have given have been able to conduct you; for I feel, and have felt deeply as we have proceeded, that they have rather had a tendency to teach us how ignorant we are than how wise; how little is really known than how much has been actually discovered. And if this be the case with respect to our course of study thus far pursued, I much suspect that what is to follow has but little chance of giving a higher character to our attainments; for the subject it proposes to touch upon, the doctrine of psychology, or the nature and properties of the mind, is the most abstruse and intractable of all subjects that relate to human entity, or the great theatre on which human entity plays its important part; and, perhaps, so far as relates to the mere discoveries of man himself, remains, excepting in a few points, much the same in the present day as it did two or three thousand years ago.

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* "Our knowledge being so narrow, it will perhaps give us some light into the present state of our minds if we look a little into the dark side, and take a view of our ignorance, which, being infinitely greater than our knowledge, may serve much to the quieting of disputes and improvement of useful knowledge ; if, discovering how far we have clear and distinct ideas, we confine our thoughts within the contemplation of those things that are within the reach of our understanding ; and launch not out into that abyss of darkness where we have not eyes to see, nor faculties to perceive any thing ; out of a presumption that nothing is beyond our comprehension. But to be satisfied of the folly of such a conceit we need not go far." Locke, Hum. Underst. IV. iii. § 22.

This subject forms a prominent section of that extensive branch of science which is generally known by the name of METAPHYSICS, and which, in modern times, has been unjustifiably separated by many philosophers from the division of PHYSICS or natural philosophy; and made a distinct division in itself. As a part of physics, or natural philosophy, it was uniformly arranged by the Greeks; as such it occurs in the works of Aristotle, as such it was regarded by Lord Bacon, as such we meet with it in Mr. Locke's correct and comprehensive classification of science, and as such it has been generally treated of by the Scottish professors of our own day. And I may add that it is very much in consequence of so unnatural a divorce, that the science of metaphysics, has too often licentiously allied itself to imagination, and brought forth a monstrous and chimerical progeny.

The term, though a Greek compound, is not to be found among the Greek writers. The first traces of it occur to us in the Physics of Aristotle, the last fourteen books of which are entitled in the printed editions, Των μετα τα Φυσικα; "Of things relating to Physics;" but even this title is generally supposed to have been applied, not by Aristotle himself, but by one of his commentators, probably Andronicus, on the transfer of the manuscripts of Aristotle to Rome, upon the subjugation of Asia by Sylla, in which city this invaluable treasure, as we had occasion to observe not long ago, had been deposited as a part of the plunder of the library of Apellicon of Teia.*

In taking a general survey of the subject immediately before us, there are three questions that have chiefly occupied the attention of the world; the essence of the mind or soul; its durability; and the means by which it maintains a relation with the sensible or external world. Let us devote the present lecture to a consideration of the first of these.

Is the essence of the human soul material or immaterial? The question, at first sight, appears to be highly important, and to involve nothing less than a belief or disbelief, not indeed in its divine origin, but in its divine similitude and immortality. Yet I may venture to affirm, that there is no question which has been productive of so little satisfaction, or has laid a foundation for wider and wilder errors, within the whole range of metaphysics. And for this plain and obvious reason, that we have no distinct idea of the terms, and no settled premises to build upon.† Corruptibility and incorruptibility, intelligent and unintelligent, organized and inorganic, are terms that convey distinct meanings to the mind, and impart modes of being that are within the scope of our comprehension; but materiality and immateriality are equally beyond our reach. Of the essence of matter we know nothing; and altogether as little of many of its more active qualities; insomuch that amidst all the discoveries of the day, it still remains a controvertible position whether light, heat, magnetism, and electricity, are material substances, material properties, or things superadded to matter and of a higher rank. If they be matter, gravity and ponderability are not essential properties of matter, though commonly so regarded. And if they be things superadded to matter, they are necessarily immaterial; and we cannot open our eyes without beholding innumerable instances of material and immaterial bodies co-existing and acting in harmonious unison through the entire frame of nature. But if we know nothing of the essence, and but little of the qualities, of matter; of that common substrate which is diffused around us in every direction, and constitutes the whole of the visible world, what can we know of what is immaterial? of the full meaning of a term that, in its strictest sense, comprehends all the rest of the immense fabric of actual and possible being, and includes in its vast circumference every essence and mode of essence of every other being, as well below as above the order of matter, and even that of the Deity himself?*

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* Ser. I. Lect. XI.

† See Locke on Hum. Unders. ch. xxiii. book ii.

Shall we take the quality of extension as the line of separation between what is material and what is immaterial? This, indeed, is the general and favourite distinction brought forward in the present day, but it is a distinction founded on mere conjecture, and which will by no means stand the test of inquiry. Is space extended? every one admits it to be so. But is space material? is it body of any kind? Des Cartes, indeed, contended that it is body, and a material body, for he denied a vacuum, and asserted space to be a part of matter itself: but it is probable that there is not a single espouser of this opinion in the present day. If then extension belong equally to matter and to space, it cannot be contemplated as the peculiar and exclusive property of the former: and if we allow it to immaterial space, there is no reason why we should not allow it to immaterial spirit. If extension appertain not to the mind, or thinking principle, the latter can have NO PLACE of existence, it can exist NO WHERE,—for WHERE, or PLACE, is an idea that cannot be separated from the idea of extension; and hence the metaphysical immaterialists of modern times freely admit that the mind has NO PLACE of existence, that it does exist NO WHERE; while at the same time they are compelled to allow that the immaterial Creator or universal spirit exists EVERY WHERE, substantially as well as virtually.

Let me not, however, be misunderstood upon this abstruse and difficult subject. That the mind has a DISTINCT NATURE, and is a DISTINCT REALITY from the body; that it is gifted with immortality, endowed with reasoning faculties, and capacified for a state of separate existence after the death of the corporeal frame to which it is attached, are in my opinion propositions most clearly deducible from revelation, and, in one or two points, adumbrated by a few shadowy glimpses of nature. And that it may be a substance strictly IMMATERIAL and ESSENTIALLY DIFFERENT from matter, is both possible and probable; and will hereafter, perhaps, when faith is turned into vision, and conjecture into fact, be found to be the true and genuine doctrine upon the subject; but till this glorious era arrives, or till, antecedently to it, it be proved, which it does not hitherto seem to have been, that matter, itself of divine origin, gifted even at present, under certain modifications, with instinct and sensation, and destined to become immortal hereafter, is physically incapable, under some still more refined and exalted and spiritualized modification, of exhibiting the attributes of the soul; of being, under such a constitution, endowed with immortality from the first, and capacified for existing separately from the external and grosser forms of the body—and that it is beyond the power of its own Creator to render it intelligent, or to give it even brutal perception,—the argument must be loose and inconclusive; it may plunge us, as it has plunged thousands before us, into errors, but can never conduct us to demonstration: it may lead us, on the one hand, to the proud Brahminical, or Platonic belief, that the essence of the soul is the very essence of the Deity, hereby rendered capable of division, and consequently a part of the Deity himself; or, on the other, to the gloomy regions of modern materialism, and to the cheerless doctrine that it dies and dissolves in one common grave with the body.[*]

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* Stud. of Med. Vol. IV. p. 37. 2d edit.

There seems a strange propensity among mankind, and it may be traced from a very early period of the world, to look upon matter with contempt. The source of this has never, that I know of, been pointed out; but it will, probably, be found to have originated in the old philosophical doctrine we had formerly occasion to advert to, that "nothing can spring from or be decomposed into nothing;"[†] and consequently that MATTER must have had a necessary and independent existence from all eternity; and have been an immutable PRINCIPLE OF EVIL running coeval with the immutable PRINCIPLE OF GOOD; who, in working upon it, had to contend with all its essential defects, and has made the best of it in his power. But the moment we admit that matter is a creature of the Deity himself; that he has produced it, in his essential benevolence, out of nothing, as an express medium of life and happiness; that, in its origin, he pronounced it, under every modification, to be VERY GOOD; that the human body, though composed of it, was at that time perfect and incorruptible, and will hereafter recover the same attributes of perfection and incorruptibility when it shall again rise up fresh from the grave,—contempt and despisal must give way to reverence and gratitude. Nor less so when, with an eye of devotional or even scientific feeling, we look abroad into the natural world under the present state of things; and behold in what an infinite multiplicity of shapes, and forms, and textures, and modifications, this same degraded substrate of matter is rendered the basis of beauty and energy, and vitality and enjoyment; equally striking in the little and the great; in the blade of grass we trample under foot, and in the glorious sun that rouses it from its winter-sleep, and re-quickens it into verdure and fragrancy; from the peopled earth to the peopled heavens; to the spheres on spheres, and systems on systems, that above, below, and all around us, fulfil their harmonious courses, and from age to age

> In mystic dance, not without song, resound
> His praise who, out of darkness, called up light.

Had the real order of nature been attended to, instead of the loose suggestions of fancy, we should have heard but little of this controversy; for it would have made us too modest to engage in it: it would have shown us completely our own ignorance, and the folly of persevering in so fruitless a chase. Let us then, in as few words as possible, and in order to excite this modesty, attempt that which has been too seldom attempted heretofore, and see how far the subject is unfolded to us in the book of the visible creation.

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[*] See Locke, on the Hum. Unders. book iv. ch. iii. § 6. as also the author's Stud. of Med. Vol. iv. p. 37. 2d Edit. 1825.

[†] In the words of Democritus, Μηδεν εκ του μη οντος γινεσθαι, μηδε εις το μη ον φθειρεσθαι. Dion. Laert. lib. ix. p. 44.

It has already appeared to us, that matter in its simplest and rudest state is universally possessed of certain active properties, as those of gravitation and repulsion, which in consequence of their universality, have been denominated essential:* but it has also appeared to us that there is an insuperable difficulty in determining whether these properties belong to common matter intrinsically, or are endowments resulting from the presence and operation of some foreign body, the ethereal medium of Sir Isaac Newton, and which, if it exist at all, is probably a something different from matter, or if material, different from common, visible, and tangible matter.

It has appeared to us next, that common matter, in peculiar states of modification, is also possessed of peculiar properties, independently of the general or essential properties which belong to the entire mass.† Thus iron and iron ore give proofs of the possession of that substance or quality which we call magnetic; glass, amber, and the muscular fibres of animals, give equal proofs of that substance or quality which we denominate electric or voltaic; and all bodies in a state of activity, of that substance or quality which is intended by the term caloric. But what is magnetism? What is voltaism? What is caloric? There is not a philosopher in the world who can answer these questions: we know almost as little of them as of gravitation, and can only trace them by their results. We can, indeed, collect and concentrate them, invisible and intangible as they are to our senses; and we have hence some reason for believing them to be distinct substances rather than mere qualities; and consequently denominate them auras. But are these auras material or immaterial? Examined by the common properties of matter, as weight, solidity, impenetrability, they appear to be the latter; for they are all equally destitute of these properties, so far as our experiments have extended; and hence they are either immaterial substances, or material substances void of the general qualities that belong to matter in its grosser forms.

Let us ascend to the next step in this wonderful and mysterious scale. It appeared from the remarks offered in a former lecture,‡ that independently of that general influence and power of attraction which every particle of matter exerts over every other particle, there are some bodies which exert a peculiar power over other bodies, which separate them from their strongest and most stubborn connexions, and as completely run away with them as the fox runs away with the young chicken. And we here behold another power introduced, and of a still higher order; a power, too, of the most complex variety, and which in different substances exhibits every possible diversity of strength.

Let us take a single example of this curious phænomenon, and let us draw it from facts that are known to almost every one. The water of the sea, and of various landsprings, as that of Epsom for example, is loaded with a certain portion of sulphuric acid, or oil of vitriol; thus impregnated, as it flows over a soil composed either wholly or in part of the earth called magnesia ; it evinces a peculiar attraction for this substance, separates it from the bed on which it has been quietly reposing, and so minutely dissolves it, as still to retain its transparency. But the attraction of the sulphuric acid for the magnesia is much less than its attraction for the fixed alkalis, potash and soda : and hence, if, to the water thus impregnated, we add a certain quantity of either of the two latter substances, the connexion between the acid and the magnesia will immediately cease : the former will evince its perference for the alkali employed ; and the magnesia no longer laid hold of by the sulphuric acid, will be precipitated, or in other words, fall by its own weight to the bottom of the water in the form of a white powder, and may be easily collected and dried. And this, in reality, is the usual mode by which this valuable earth is obtained in its pure state.

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* Ser. I. Lect. IV. † Ser. I. Lect. V. ‡ Ser. I. Lect. V.

But the sulphuric acid having thus shown a stronger attraction for an alkali than for an earth, is there no substance for which it discovers a stronger attraction than for an alkali ? There are various : it may be sufficient to mention caloric or the matter of heat. And hence, exposed to the action of heat, it soon becomes volatile, unites itself to the heat, flies off with it in vapour, and now leaves the alkali behind as it before left the megnesian earth. Glass-manufacturers take advantage of this superior attraction of the mineral acids for heat compared with their attraction for alkalis, and employ, in their formation of glass, common sea-salt, which is a combination of an acid and an alkali ; drive off the former from the latter by the aid of a very powerful fire, and then obtain a substance which is absolutely necessary for the production of this material.

These curious and altogether inexplicable properties and preferences we call chemical affinities and chemical elections ; and there are numerous instances in which the substances, thus uniting themselves together, evince an order and regularity of the most wonderful precision, and which is nowhere exceeded, in the developement of the most elegant organ of animated nature. And I now particularly allude to the phænomena of crystallization ; the different kinds of which, produced by the consolidation of different substances, uniformly maintain so exact an arrangement in the peculiar shape of the minute and central nucleus, or the two or three elementary particles that first unite into a particular figure, and follow up with so much nicety the same precise and geometrical arrangement through every stage of their growth, that we are able, in all common cases, to distinguish one kind of crystal from another by its geometrical figure alone ; and with the same ease and in the same manner as we distinguish one kind of animal from another by its general make or generic structure. The form of these elementary particles we can no more trace to a certainty than the bond of their union ; but there is great reason for believing them to be spheres or spheroids, as first conjectured by that most acute and indefatigable philosopher Dr. Hooke, and since attempted to be explained by Dr. Wollaston in a late Bakerian lecture.*

Such are the most striking powers that occur to us on a contemplation of the unorganized world. From unorganized let us ascend to organized nature. And here the first peculiar property that astonishes us is the principle of life itself;—that wonderful principle equally common to plants and animals, which maintains the individuality, connects organ with organ, resists the laws of chemical change or putrefaction, which instantly commence their operation as soon as this agent or endowment ceases; and which, with the nicest skill and harmony, perpetuates the lineaments of the different kinds and species through innumerable generations. It is an agency which exists as completely in the seed or the egg as in the mature plant or animal: for as long as it is present, the seed of the egg is capable of specific developement and growth; but the moment it quits its connexion, they can no more grow than a grain of gunpowder.

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* Phil. Trans. 1813. p. 51.

What now is this wonderful principle that so strikingly separates organized from inorganized matter? that, as I have observed on a former occasion, from the first moment it begins to act infuses energy into the lifeless clod; draws forth form and order, and individual being from unshapen matter, and stamps with organization and beauty the common dust we tread upon?* I have called it an agent or endowment: is it nothing more than these? is it a distinct essence? and if so, is this essence refined, etherealized matter, freed from the more obvious properties of grosser matter, or is it strictly immaterial? It has been said by different physiologists to be oxygene, caloric, the electric or the galvanic gas; but all this is mere conjecture; and even of several of these powers we know almost as little as we do of the vital principle itself, and are incapable of tracing them in the vegetable system.

The next curious energy we meet with in organized nature, and which also equally belongs to animals and vegetables, is instinct. This I have defined to be "the operation of the vital principle, or the principle of organized life by the exercise of certain natural powers directed to the present or future good of the individual, or of its progeny."† But what are these powers, with which the vital principle is thus marvellously gifted, and which enables it, under different circumstances, to avail itself of different means to produce the same end?—that directs plants to sprout forth from the soil, and expand themselves to the reviving atmosphere; fishes to deposite their eggs in the sands; birds in nests, of the nicest and most skilful contrivance; and the wilder quadrupeds to accomplish the same purpose in lairs or subterraneous caverns; that guides the young of every kind to its proper food, and, whenever necessary, teaches it how to suck? Are these powers also material, or are they immaterial? Are they simple properties issuing out of a peculiar modification of matter, or something superadded to the material frame?

In the confused language and confused ideas of various metaphysical hypotheses, and even of one or two that pretend to great exactness in these respects, instinct is made a part or faculty of the mind: and hence we hear of a moral instinct. But has the polype, then, or the hydatid a mind? Are we to look for a mind in the midst of sponges, corals, and funguses?—in the spawn of frogs, or the seeds of mushrooms? Instinct, however, the operation of the principle of life, equally superintending the entire frame, and every separate part of it, guiding it to its perfect developement, exciting its peculiar energies, remedying its occasional evils, and providing for a future progeny, is equally to be traced in all of them? Are instinct, then, and mind the same thing? or is the vocabulary of the hypotheses I now advert to, and shall have occasion to examine more at large hereafter, so meagre and limited that it is necessary to employ the same term to express ideas that have no connexion with each other, and which cannot, therefore, be thus expressed without the grossest confusion?

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* Ser. I. Lect. IX.

† Ser. II. Lect. IV.

It is high time to be more accurate, and to have both determinate words and determinate ideas; and it has been one object of this course of instruction to define what ought to be the real distinction between instinct, sensation, and intelligence.

But let us ascend a step higher in the great scale of life; let us quit the vegetable for the animal kingdom. If I take the egg or grain of a mustard-seed, and the egg of a silkworm, where is the chemist or physiologist that will point out to me the diversity of their structure, or unfold the cause of those different faculties which they are to evince on future developement and growth? At present, so far as they appear to us, they are equally common matter, actuated by the same common living principle, directed to different ends. To give them developement and mature form, we equally expose them to the operation of the sun and the atmosphere, and, in the case of the mustard-seed, of moisture: and we are not conscious of exposing them to any thing else; all which, again, so far as we are acquainted with them, are nothing but matter in different states of modification. Yet the animal egg produces a new and a much higher power, which we denominate sensation, while the vegetable egg produces nothing of the kind. What is sensation, and from what quarter has it been derived? Is it a mere property, or a distinct essence? Is it material, or is it immaterial?

This, also, has occasionally been called instinct, and been contemplated as of instinctive energy. With equal confusion it has also been called or contemplated as a property of mind. It is neither the one nor the other: it is equally different from both. We trace, indeed, its immediate seat of residence; for we behold in the silk-worm a peculiar organ which does not exist in the mustard-plant, and to which, and which alone, sensation always attaches itself; and to this organ we give the name of a nervous system. But to become acquainted with the organ, in which sensation resides, is no more to become acquainted with the essence of sensation itself, than to know the principle of life because we know the general figure of the individual animal or vegetable in which it inheres; or than to know what gravitation is because we see the matter which it actuates.

As simple nerves, or a nervous cord, such as that of the spinal marrow, is the proper organ of sensation or feeling, the gland of a brain, from which the nervous cord usually, though not always, shoots, is the proper organ of intelligence; and as I had occasion to observe in a former study, when lecturing upon the subject of the senses, the degree of intelligence appears, in every instance we are acquainted with, to be proportioned, not, indeed, to the size of the brain as compared with that of the animal to which it belongs, as was conjectured by Aristotle, and has been the general belief almost to the present day, but as compared with the aggregate bulk of nerves that issue from it.* The larger the brain and the less the nerves, the higher and more comprehensive the intelligence: the smaller the brain and the larger the nerve, the duller and more contracted. In man, of all animals whatever, the brain is the largest, and the nerves comparatively with its bulk the smallest: in the monkey tribes it makes an approach to this proportion, but there is still a considerable difference; in birds a somewhat greater difference; in amphibials the brain is very small in proportion to the size of the nervous cord; in fishes it is a bulb not much larger than the nervous cord itself; in insects there is no proper brain whatever; the nervous cord that runs down the back originating near the mouth; sometimes of an uniform diameter with the cord itself, and sometimes rather larger; and in infusory and zoophytic worms we have no trace either of nerves or brain.

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* Ser. I. Lect. XV.

In these last, therefore, it is possible, and indeed probable, as I have already observed, that there is no sensation: the vital principle, and the instinctive faculty, which is the operation of the vital principle, by the exercise of certain natural powers constantly appertaining to such principle, alone producing all the phænomena of life as in plants. In most insects, for the same reason, it is possible, and indeed probable, that though there is sensation, there is little or no intelligence: the brain, which is the sole seat or organ of intelligence, being totally destitute, in most of them, and of very minute compass in the rest. In fishes we have reason to apprehend different degrees of intelligence; in many amphibials somewhat more; more still in birds and quadrupeds, and most of all in man.

But what is intelligence, which is a distinct principle from sensation, and to which, as in the case of sensation, a distinct organ is appropriated? An organ, moreover, which, like that of simple sensation, may be also produced out of an insentient egg by the mere application, so far as we are able to trace the different substances in nature, of a certain proportion of heat; for the egg of the hen, unquestionably insentient when first laid, becomes equally hatched and endowed with the organs and properties both of sensation and intelligence, by the application of a certain portion of warmth, whether that warmth be derived from the body of the hen, of a dung-hill, an oven, or the sun. But though we know the organ, what information does this give us of the thing itself? In what respect is intelligence connected with the brain? Does it result from its mere peculiarity of structure, secreted, like the blood, but of a finer and more attenuate crasis, or is it a something superadded to the organ? Is it matter in its most active, elaborate, and etherealized form, or is it something more than matter of any kind? and, if so, how has this superadded essence been communicated?

To this point we can proceed safely, and see our way before us: but shadows, clouds, and darkness rest on all beyond, while the gulf on which we sail is unfathomable to the plummet of mortals.

It is something more than matter, observes one class of philosophers, for matter itself is essentially unintelligent, and is utterly incapable of thought. But this is to speak with more confidence than we are warranted; and unbecomingly to limit the power of the Creator. It has already appeared that we know nothing of the essential properties of matter. If it be capable of gravitation, of elective attractions, of life, of instinct, of sensation, there does not seem to be any absurdity in supposing it may be capable of thought: and if all these powers or endowments result from something more than matter, then is the visible world as much an immaterial as a material system.

On the other hand, it is as strongly contended by an opposite class of philosophers, and the same train of arguments has been continued, almost without variation, from the days of Epicurus, that the principle of thought or the human mind must be material; for otherwise the frame of man, we are told, will be made to consist of two distinct and adverse essences, possessing no common property or harmony of action. But this is to speak with as unbecoming confidence as in the former case. The great visible frame of the world seems to point out to us in every part of it a co-existence either of different essences or of different natures—of matter and a something which is not matter; or of common matter and matter possessed of properties that it does not discover in its common form. Yet all these, so far from being adverse to each other, subsist in the strictest union, and evince the completest harmony of action. And hence the soul, or intelligent principle, though combined with matter, though directly operating from a material organ, may be a something distinct from matter, and more than matter, even in its most active, ethereal, and spiritualized forms: though, whatever be its actual essence, it undoubtedly makes the nearest approach to it under such a modification.

In reality, under some such kind of ethereal or shadowy make, under some such refined or spiritualized and evanescent texture, it seems in almost all ages and nations to have been handed down by universal tradition, and contemplated by the great mass of the people, whatever may have been the opinion of the philosophers, as soon as it has become separated from the body. And the opinion derives some strength from the manner in which it is stated to have been first formed in the Mosaic records, which intimate it to be a kind of divine breath, vapour, or aura, or to have proceeded from such a substance; for "God," we are told, "breathed into man's nostrils THE BREATH OF LIFE, (נשמת חיים) and he became a living soul."*

Opposed as the two hypotheses of materialism and of immaterialism are to each other, in the sense in which they are commonly understood, it is curious to observe how directly and equally they tend to one common result, with respect to a point upon which they are conceived to differ diametrically; I mean an assimilation of the human soul to that of brutes.

The materialist, who traces the origin of sensation and thought from a mere modification of common matter, refers the perception and reflection of brutes to the very principle which produces them in man; and believing that this modification is equally, in both instances, destroyed by death, maintains that "as the one dieth, so dieth the other; so that a man hath no pre-eminence above a beast;"† whence his hope of future existence, apparently like that of Solomon, who was without the light of the Christian Scriptures, depends exclusively upon a resurrection of the body.

The immaterialist, on the contrary, who conceives that mere matter is incapable, under any modification, of producing sensation and thought, is under the necessity of supplying to every rank of being possessing these powers, the existence of another and of a very different substance combined with it; a substance not subject to the changes and infirmities of matter, and altogether impalpable and incorruptible. For if sensation and ideas can only result from such a substance in man, they can only result from such a substance in brutes; and hence the level between the two is equally maintained by both parties; the common materialist lowering the man to the brute, and the immaterialist exalting the brute to the man. The immaterialist, however, on the approach of dissolution, finds one difficulty peculiar to himself, for he knows not, at that period, how to dispose of the brutal soul: he cannot destroy an incorruptible substance, and yet he cannot bring himself to a belief that it is immortal. This difficulty seems to have been peculiarly felt by the very excellent Bishop Butler. He was too cautious a reasoner, indeed, to enlist the term IMMATERIAL into any part of his argument; not pretending to determine, as being a point of no importance whatever, "whether our *living substances* (those that shall survive the body) be material or immaterial:"* but, as a faculty of intelligence is discernible in brutes as well as in man, he thought himself compelled to ascribe it in both to a common principle; and believing this principle to be immortal in the latter, he supposed it also to be immortal in the former; and hence speaks of the "natural immortality of brutes."† But as to what becomes of this natural immortality of the brute creation after death, he says nothing whatever, and even regards the inquiry as "invidious and weak."‡

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* Gen. ii. 7.

† Eccles. iii. 19.

By some immaterialists, and particularly by Vitringa and Grotius, it has been conceived that, as something distinct from matter must be granted to brutes, to account for their powers of perception, mankind are in possession of a principle superadded to this, and which alone constitutes their immortal spirit. But such an idea, while it absurdly supposes every man to be created with two immaterial spirits, leaves us as much as ever in the dark as to the one immaterial, and consequently incorruptible, soul or principle possessed by brutes. The insufficiency of the solution has not only been felt but acknowledged by other immaterialists; and nothing can silence the objection, but to advance boldly, and deny that brutes have a soul or percipient principle of any kind; that they have either thought, perception, or sensation; and to maintain in consequence, that they are mere mechanical machines, acted upon by external impulsions alone. Des Cartes was sensible that this is the only alternative: he, therefore, cut the Gordian knot, and strenuously contended for such an hypothesis: and the Abbé Polignac, who intrepidly follows him, gravely devotes almost a whole book of his anti-Lucretius to an elucidation of this doctrine: maintaining that the hound has no more will of his own in chasing the fox than the wires of a harpsichord have in exciting tones; and that, as the harpsichord is mechanically thrown into action by a pressure of the fingers upon its keys, so the hound is mechanically urged onwards by a pressure of the stimulating odour that exhales from the body of the fox upon his nostrils. Such are the fancies which have been invented to explain what appears to elude all explanation whatever; and consequently to prove that the hypothesis itself is unfounded.

Yet the objections that apply to the conjecture of materialism, as *commonly* understood and professed, are still stronger. By the denial of an intermediate state of being between the death and the resurrection of the body, it opposes not only what appears to be the general tenour, but what is, in various places, the direct declaration of the Christian Scriptures; and by conceiving the entire dissolution and dispersion of the percipient as well as impercipient parts of the animal machine, of which all the atoms may become afterwards constituent portions of other intelligent beings, it renders a resumed individuality almost, if not altogether, impossible.§

The idea, that the essence or texture of the soul consists either wholly or in part of spiritualized, ethereal, gaseous, or radiant matter, capable of combining with the grosser matter of the body, and of becoming an object of sense, seems to avoid the difficulties inherent to both systems. It says to the materialist, matter is not *necessarily* corruptible; as a believer in the Bible, you admit that it is not so upon your own principle, which maintains the body was incorruptible when it first issued from the hands of its Maker, and that it will be incorruptible upon its resurrection. It says to the immaterialist, the term *immaterial* conveys no determinate idea; it has been forcibly enlisted into service, and at the same time by no means answers the purpose that was intended. It tells him that it is a term not to be found in the Scriptures, which, so far from opposing the belief that the soul, spirit, or immortal part of man, is either wholly or in combination, a system or radiant of ethereal matter, seems rather, on the contrary, to countenance it, not only as I have already observed, by expressly asserting that it was originally formed out of a divine breath, aura, or vapour, but by presenting it to us under some such condition in every instance in which departed spirits are stated to have re-appeared.

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* Analysis of Religion, Natural and Revealed, Part i. ch. i.

† Id. Part i. ch. i. p. 30. Edit. 1802. ‡ Id. p. 29.

§ See the author's Life of Lucretius, prefixed to his translation of the poem De Rerum Natura, Vol. I. p. 92.

That a principle of the same kind, though under a less active and elaborate modification, appertains to the different tribes of brutes, there can, I think, be no fair reason to doubt. Yet it by no means follows that in them it must be also immortal. Matter, as we have already seen, is not necessarily corruptible, nor have we any reason to suppose, that whatever is immaterial is necessarily incorruptible. Immortality is in every instance a special gift of the Creator; and so wide is the gulf that exists between the intelligence of man and that of the brute tribes, that there can be no difficulty in conceiving where the line is drawn, and the special endowment terminates. It is an attribute natural to the being of man, merely because his indulgent Maker has made it so. But there is nothing either in natural or revealed religion that can lead us to the same conclusion in respect to brutes; and hence, to speak of their *natural immortality* is altogether visionary and unphilosophical.

In reality, the difference between this suggested hypothesis and that of the general body of immaterialists, is little more than verbal. For there are few of them who do not conceive in their hearts (with what logical strictness I stay not to inquire) that the soul, in its separate state, exists under some such shadowy and evanescent form; and that, if never suffered to make its appearance in the present day, it has thus occasionally appeared in earlier ages, and for particular purposes. Yet what can in this manner become manifest to material senses, must have at least some of the attributes of matter in its texture, otherwise it could produce no sensible effect or recognition. From what remote source universal tradition may have derived this common idea of disembodied spirits, I pretend not to ascertain; the inquiry would, nevertheless, be curious, and might be rendered important: it is a pleasing subject, and embued with that tender melancholy that peculiarly befits it for a mind of sensibility and fine taste. Its universality, independently of the sanction afforded to it by revealed religion, is no small presumption of its being founded in fact. But I throw out the idea rather as a speculation to be modestly pursued, than as a doctrine to be precipitately accredited. Enough, and more than enough has been offered, to show that in the abstruse subject before us, nothing is so becoming as humility; that we have no pole-star to direct us: no clue to unriddle the perplexities of the labyrinth in which we are wandering; that every step is doubtful; and that to expatiate is perhaps only to lose ourselves. To show this has been my first object; my second has been to conciliate discordant opinions, and to connect popular belief with philosophy.

But I have also aimed at a much higher mark; and have followed up the aim through the general train of reasoning introduced into the preceding division of this course of instruction. I have endeavoured to show that, though every part of the visible creation is transient and imperfect, every part is in a state of progression, and striving at something more perfect than itself; that the whole unfolds to us a beautiful scale of ascension: every division harmoniously playing into every other division, and, with the nicest adjustment, preparing for its furtherance. The mineral kingdom lays a foundation for the vegetable, the vegetable for the animal: infancy for youth, youth for manhood, and manhood for the wisdom of hoary hairs. We have hence strong ground, independently of that furnished us by revelation, for concluding that the scene will not end here: that we are but upon the threshold of a vast and incomprehensible scheme, that will reach beyond the present world and run coeval with eternity. The admirable Bishop of Durham, to whose writings I have already occasionally adverted, pursues this argument with great force in his immortal Analogy, and shows, with impressive perspicuity, the general coincidence of design that runs throughout the natural and the moral government of Providence, all equally leading to a future and more perfect state of things. "The natural and moral constitution and government of the world," says he, "are so connected as to make up together but one scheme; and it is highly probable that the first is formed and carried on merely in subserviency to the latter: as the vegetable is for the animal, and organized bodies for minds. Every act, therefore, of divine justice and goodness may be supposed to look much beyond itself, and its immediate object may have some reference to other parts of God's moral administration and to a genuine moral plan; and every circumstance of this his moral government may be adjusted beforehand, with a view to the whole of it.—It is hence absurd, absurd to the degree of being ridiculous, if the subject were not of so serious a kind, for men to think themselves secure in a vicious life; or even in that immoral thoughtlessness which far the greatest part of them are fallen into."*

LECTURE II.

ON THE NATURE AND DURATION OF THE SOUL, AS EXPLAINED BY POPULAR TRADITIONS, AND VARIOUS PHILOSOPHICAL SPECULATIONS.

We have entered upon a subject in which human wisdom or imagination can afford us but very little aid; and I have already observed, that I have rather touched upon it, in order that, with suitable modesty, we may know and acknowledge our own weakness, and apply to the only source from which we can derive any real information concerning it, than to support any hypothesis that can be deduced from either physical or metaphysical investigations. "The science of abstruse learning," observes Mr. Tucker, and no man was ever better qualified to give an opinion upon it, "when completely attained, is like Achilles's spear, that healed the wounds it had made before. It casts no additional light upon the paths of life, but disperses the clouds with which it had overspread them. It advances not the traveller one step in his journey, but conducts him back again to the spot from whence he had wandered."† But if it do not discover new truths, it prepares, or should prepare, the mind for apprehending those that are already in existence with a greater facility, and far more accurately appreciating their value.

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* Analysis of Religion, Natural and Revealed, Part i. chap. vii. p. 148, 149. 165. Edit. 1802.

† Light of Nature Pursued, chapter xxxii.

In our last lecture we took a glance at several of the discordant opinions, supported respectively by men of the deepest learning and research, that have been offered in relation to the essence of the mind or soul; and showed by a scale of analysis conducted through all the most striking modifications of that plastic and fugitive substance which composes the whole of the visible world, that all such discussions must be necessarily uncertain, and considerably less likely to be productive of truth than of error. But there is a question of far more consequence to us than the nature of the soul's essence, and that is, the nature of its duration. Is the soul immortal? Is it capable of a separate existence? Does it perish with the body as a part of it? Or if a distinct principle, does it vanish into nothingness as soon as the separation takes place? What does philosophy offer upon this subject? This too has been studied from age to age; the wisest of mankind have tried it in every possible direction: new opinions have been started, and old opinions revived;—and what, after all, is the upshot? The reply is as humiliating as in the former case; vanity of vanities, and nothing more; utter doubt and indecision,—hope perpetually neutralized by fear.

If we turn to the oldest hypotheses of the East,—to the Vedas of the Bramins and the Zendavesta of the Parsees,—to those venerable but fanciful stores of learning, from which many of the earliest Greek schools drew their first draughts of metaphysical science, we shall find indeed a full acknowledgment of the immortality of the soul, but only upon the sublime and mystical doctrine of emanation and immanation, as a part of the great soul of the universe; issuing from it at birth, and resorbed into it upon the death of the body; and hence altogether incapable of individual being, or a separate state of existence. If we turn from Persia, Egypt, and Hindustan to Arabia, to the fragrant groves and learned shades of Dedan and Teman, from which it is certain that Persia, and highly probable that Hindustan derived its first polite literature, we shall find the entire subject left in as blank and barren a silence, as the deserts by which they are surrounded; or, if touched upon, only touched upon to betray doubt, and sometimes disbelief. The tradition, indeed, of a future state of retributive justice seems to have reached the schools of this part of the world, and to have been generally, though perhaps not universally, accredited; but the future existence it alludes to is that of a resurrection of the body, and not of a survival of the soul after the body's dissolution. The oldest work that has descended to us from this quarter (and there is little doubt that it is the oldest, or one of the oldest works in existence)* is that astonishing and transcendant composition, the book of Job;—a work that ought assuredly to raise the genius of Idumæa above that of Greece, and that of itself is demonstrative of the indefatigable spirit with which the deepest as well as the most polished sciences were pursued in this region, during what may be comparatively called the youth and day-spring of the world. Yet in this sublime and magnificent poem, replete with all the learning and wisdom of the age, the doctrine upon the subject before us is merely, as I have just stated it, a patriarchal or traditionary belief of a future state of retributive justice, not by the natural immortality of the soul, but by a resurrection of the body. And the same general idea has for the most part descended in the same country to the present day; for the Alcoran, which is perpetually appealing to the latter fact, leaves the former almost untouched, and altogether in a state of indecision, whence the expounders of the Eslam scriptures, both Sonnites and Motazzalites, or orthodox and heterodox, are divided upon the subject, some embracing and others rejecting it. And it is hence curious to observe the different grounds appealed to in favour of a future existence, in the most learned regions of the east: the Hindu philosophers totally and universally denying a resurrection of the body, and supporting the doctrine alone upon the natural immortality of the soul, and the Arabian philosophers passing over the immortality of the soul, and resting it alone upon a resurrection of the body.

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* Ser. II. Lect. X.

The schools of Greece, as I have already observed, derived their earliest metaphysics from the gymnosophists of India; and hence, like the latter, while for the most part they contended for the immortal and incorruptible nature of the soul, they in like manner overlooked or reprobated the doctrine of a resurrection of the body. On which account, when St. Paul, with an equal degree of address and eloquence, introduced this subject into his discourse in the Agora or great square of Athens, the philosophers that listened to it carried him to Areopagus, and inquired what the new doctrine was of which he had been speaking to the people.

The earliest Greek schools, therefore, having derived this tenet from an Indian source, believed it, for the most part, after the Indian manner. And hence, though they admitted the immortality of the soul, they had very confused ideas of its mode of existence; and the greater number of them believed it, like the Hindus, to be resorbed, after the present life, into the great soul of the world, or the creative spirit, and consequently to have no individual being whatsoever.

Such, more especially, was the doctrine of Orpheus and of the Stoics; and such, in its ultimate tendency, that of the Pythagoreans, who, though they conceived that the soul had, for a certain period, an individual being, sometimes involved in a cloudy vehicle, and sleeping in the regions of the dead, and sometimes sent back to inhabit some other body, either brutal or human, conceived also that at length it would return to the eternal source from which it had issued, and for ever lose all personal existence in its essential fruition; a doctrine, under every variety, derived from the colleges of the East.

I have said that this principle was imported by the Pythagorists, and the Greek schools in general, from the philosophy of India. The slightest dip into the Vedas will be a sufficient proof of this. Let us take the following splendid verse as an example, upon which the Vedantis peculiarly pride themselves, and which they have, not without reason, denominated the Gayatri, or most holy verse.

"Let us adore the supremacy of that divine sun the Bhargas, or godhead, who illuminates all, who recreates all, FROM WHOM ALL HAVE PROCEEDED, TO WHOM ALL MUST RETURN, whom we invoke to direct our understandings aright in our progress towards his holy seat."*

The doctrine of the later Platonists was precisely of the same kind, and it was very extensively imbibed, with the general principles of the Platonic theory, by the poets and philosophers who flourished at the period of the revival of literature. Lorenzo de Medici is well known to have been warmly attached to this sublime mysticism; yet he has made it a foundation for some of the sweetest and most elevated devotional poetry that the world possesses. His magnificent address to the supreme Being has seldom been equalled. I cannot quote it before a popular audience in its original, but I will beg your acceptance of the following imperfect translation of two of its stanzas, that you may have some glance into its merit :

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* Sir Wm. Jones, vi. p. 417.

Father Supreme ! O let me climb
That sacred seat, and mark sublime
Th' essential fount of life and love ;
Fount, whence each good, each pleasure flows.
O, to my view thyself disclose !
The radiant heaven thy presence throws !
O, lose me in the light above.

Flee, flee, ye mists ! let earth depart :
Raise me, and show me what thou art,
Great sum and centre of the soul !
To thee each thought, in silence, tends ;
To thee the saint, in prayer, ascends ;
Thou art the source, the guide, the goal ;
The whole is thine, and thou the whole.*

While such, however, were the philosophical traditions, the popular tradition appears to have been of a different kind, and as much more ancient as it was more extensive. It taught that the disembodied spirit becomes a ghost as soon as it is separated from the corporeal frame ; a thin, misty, or aerial form, somewhat larger than life, with a feeble voice, shadowy limbs ; knowledge superior to what was possessed while in the flesh ; capable, under particular circumstances, of rendering itself visible ; and retaining so much of its former features as to be recognised upon its apparition ; in a few instances wandering about for a certain period of time after death, but for the most part conveyed to a common receptacle situated in the interior of the earth, and denominated scheol (שְׁאוֹל), hades (ἀδης) hell, or the world of shades.

Such was the general belief of the multitude in almost all countries from a very early period of time ; with this difference, that the hades of various nations was supposed to exist in some remote situation on the surface of the earth, and that of others in the clouds. The first of these modifications of the general tradition is still to be traced among many of the African tribes, and perhaps all the aboriginal tribes of North America. That most excellent man, William Penn, who appears with some singularities, to have united in his character as much moral goodness, natural eloquence, and legislative wisdom, as ever fell to the lot of any one, has sufficiently noticed this fact, in regard to the American tribes, in his valuable account of the country addressed to "The Free Society of Traders of Pennsylvania," drawn up from an extensive and actual survey, and constituting, so far as it goes, one of the most important and authentic documents we possess. "These poor people," says he, "are under a dark night in things relating to religion, to be sure, the tradition of it: yet they believe a God and immortality without the help of metaphysics; for they say there is a great king who made them, who dwells in a glorious country to the southward of them, and that the souls of the good shall go thither, where they shall live again."* And it is upon the faith of this description that Mr. Pope drew up that admirable and well known picture of the same tradition, that occurs in the first epistle of his Essay on Man, and is known to every one.

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* Concedi, O Padre ! l'alta e sacra sede
Monti la mente, e vegga el vivo fonte,
Fonte ver bene, onde ogni ben procede.
Mostra la luce vera alla mia fronte,
E poiche conosciuto e 'l tuto bel sole,
Dell' alma ferma in lui luci pronte.

Fuga le nebbie, e le terrestre mole
Leva da me, e splendi in la tua luce ;
Tu se' quel sommo ben che chiascun vuole ;
A te dolce riposo si conduce,
E te come suo fin, vede ogni pio ;
Tu se' principio, portatore e duce,
La vita, e 'l termino, Tu sol, Magno Dio.

> Lo! the poor Indian, whose untutor'd mind
> Sees God in clouds, or hears him in the wind:
> His soul proud science never taught to stray
> Far as the solar walk or milky way;
> Yet simple nature to his hope has given
> Beyond the cloud-topt hill, an humbler heaven;
> Some safer world in depth of woods embrac'd,
> Some happier island in the watery waste;
> Where slaves once more their native land behold,
> No fiends torment, no Christians thirst for gold.

The tradition which describes the hades, or invisible world, as seated in the clouds, was chiefly common to the Celtic tribes, and particularly to that which at an early age peopled North Britain. It is by far the most refined and picturesque idea that antiquity has offered upon the subject, and which has consequently been productive, not only of the most sublime, but of the most pathetic descriptions to which the general tradition has given rise under any form. The Celtic bards are full of this imagery; and it is hence a chief characteristic in the genuine productions of Ossian, which, in consequence, assume a still higher importance as historical records than as fragments of exquisite poetry. Let me, in proof of this, quote his fine delineation of the spirit of Crugal from a passage in the second book of Fingal, one of his best authenticated poems,† premising that the importance of the errand, which is to warn his friends, "the sons of green Erin," of impending destruction, and to advise them to save themselves by retreat, sufficiently justifies the apparition. "A dark red stream of fire comes down from the hill. Crugal sat upon the beam: he that lately ell by the hand of Swaren striving in the battle of heroes. His face is like the beam of the setting moon: his robes are of the clouds of the hill: his eyes are like two decaying flames. Dark is the wound on his breast. The stars dim-twinkled through his form; and his voice was like the sound of a distant stream. Dim and in tears he stood, and stretched his pale hand over the hero. Faintly he raised his feeble voice, like the gale of the reedy Lego. 'My ghost, O Connal! is on my native hills, but my corse is on the sands of Ullin. Thou shalt never talk with Crugal, nor find his lone steps on the heath. I am light as the blast of Cromla, and I move like the shadow of mist. Connal, son of Colgar! I see the dark cloud of death. It hovers over the plains of Lena. The sons of green Erin shall fall. Remove from the field of ghosts.' Like the darkened moon, he retired in the midst of the whistling blast."

Let us take another very brief but very beautiful example. "Trenmor came from his hill at the voice of his mighty son. A cloud, like the steed of the stranger, supported his airy limbs. His robe is of the mist of Lano, that brings death to the people. His sword is a green meteor half extinguished. His face is without form and dark. He sighed thrice over the hero; and thrice the winds of the night roared around. Many were his words to Oscar. He slowly vanished, like a mist that melts on the sunny hill."

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* Clarkson's Life of Wm. Penn, vol. i. p. 391.

† See Report of the Committee of the Highland Society of Scotland appointed to inquire into the nature and authenticity of the Poems of Ossian, drawn up, according to the directions of the Committee, by Henry Mackenzie, Esq. its Convener or Chairman, p. 153, and pp. 190—260.

The idea of his still pursuing his accustomed occupation of riding with his glittering sword, (its glitter now half extinguished, and of a green hue,) on the steed of the stranger—a steed won in battle—his own limbs rendered airy, and the steed dissolved into the semblance of a cloud—is not only exquisite as a piece of poetic painting, but as a fact consonant with the popular tradition of all other countries, which uniformly allotted to the shades or ghosts of their respective heroes, their former passions and inclinations, the pastimes or employments to which they had devoted themselves while on earth, and the arms or implements they had chiefly made use of. Thus, the Scandinavian bard, Lodbrog, while singing his own death-song, literally translated from the Runic into Latin by Olaus Wormius, and transferring, in like manner, the pursuits of his life to his pursuits after death: "In the halls of our father Balder I know seats are prepared, where we shall soon drink all out of the hollow sculls of our enemies. In the house of the mighty Odin no brave man laments death. I come not with the voice of despair to Odin's hall."*

The same popular belief was common to the Greeks and Romans. Thus, Æneas, according to Virgil, in his descent to the infernal regions, beholds the shades of the Trojan heroes still panting for fame, and amusing themselves with the martial exercises to which they had been accustomed, and with airy semblances of horses, arms, and chariots:

> The chief surveyed full many a shadowy car,
> Illusive arms, and coursers trained for war,
> Their lances fixed in earth, their steeds around,
> Now free from harness, graze the mimic ground.
> The love of horses which they had, alive,
> And care of chariots, after death survive.†

Virgil, while true to the tradition of his country, is well known to have copied his description from Homer; and in Homer's time the same popular tradition was common to the Jews, and runs through almost all their poetry. It is thus Isaiah, who was nearly contemporary with Homer, satirizes the fall of Belshazzar, ch. xiv. 9.

> The lowermost HELL is in motion for thee,
> To congratulate thy arrival:
> For thee arouseth he the MIGHTY DEAD,
> All the chieftains of the earth.

The term MIGHTY DEAD is peculiarly emphatic. The Hebrew word is רפאים (Rephaim,) the "gigantic spectres," "the magnified and mighty ghosts;" exhibiting, as I have already observed, a form larger than life, or, as Juvenal has admirably expressed it upon a similar occasion, xiii. 221.

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* See Blair's Dissertations on Ossian.

† Arma procul, currusque virum miratur inanes.
Stant terra defixæ hastæ, passimque soluti
Per campos pascuntur equi; quæ gratia currum
Armorumque fuit vivis, quæ cura nitentes
Pascere equos; cadem sequitur tellure repostos.
Æneid, vi. 651.

> ——Major imago
> Humana.
> A more than mortal make:

whence the term Rephaim is rendered in the Septuagint, Γηγηνεις, and by Theodotion, Γιγαντες.

To the same effect, Ezekiel, about a century afterwards, in his sublime prophecy of the destruction of Egypt, a piece of poetry that has never been surpassed in any age or country, chap. xxxii. 19—26. I can only quote a few verses, and I do it to prove that the tradition common to other nations, that the ghosts of heroes were surrounded in hades, or the invisible world, with a shadowy semblance of their former dress and instruments of war, was equally common to Judea.

> v. 2. Wail! Son of Man, for multitudinous Egypt,
> Yea, down let her be cast,
> Like the daughters of the renowned nations,
> Into the nether parts of the earth,
> Among those that have descended into the pit.
> Thou! that surpassest in beauty!
> Get thee down.—
> To the sword is she surrendered:
> Draw him forth, and all his forces.
> The chieftains of the MIGHTY DEAD (רפארם)
> Call to him and his auxiliaries
> From the lowest depths of hell,—
> v. 27. To the grave who have descended
> With their instruments of war;
> With their swords placed under their heads.

From what quarter this popular and almost universal tradition was derived, or in what age it originated, we know not. I have said that it appears to be more ancient than any of the traditions of the philosophers; and in support of this opinion I chiefly allude to one or two hints at it that are scattered throughout the book of Job, which I must again take leave to regard as the oldest composition that has descended to us. I do not refer to the fearful and unrivalled description of the spectre that appeared to Eliphaz, because the narrator himself does not seem to have regarded this as a human image, but, among other passages,* to the following part of the afflicted patriarch's severe invective against his friend Bildad:

> Yea the MIGHTY DEAD are laid open from below,
> The floods and their inhabitants.
> HELL is naked before him;
> And DESTRUCTION hath no covering.

Bildad had been taunting Job with ready-made and proverbial speeches; and there can be no doubt that this of Job's, in reply, is of the same sort; imbued with popular tradition, but a tradition not entering into the philosophical creed either of himself or of any of his friends; for throughout the whole scope of the argument upon the important question of a future being, the immortality and separate existence of the soul is never once brought forward; every ray of hope being, as I have already observed, derived from the doctrine of the future resurrection of the body.

In many parts of the world, though not in all, this common tradition of the people was carried much farther, and, under different modifications, made to develope a very important and correct doctrine; for it was believed, in most countries, that this hell, hades, or invisible world, is divided into two very distinct and opposite regions by a broad and impassable gulf; that the one is a seat of happiness, a paradise, or elysium, and the other a seat of misery, a Gehenna, or Tartarus; and that there is a supreme magistrate, and an impartial tribunal belonging to the infernal shades, before which the ghost must appear, and by which he is sentenced to the one or the other, according to the deeds done in the body.

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* Chap. xx. 11.

Egypt is generally said to have been the inventress of this important and valuable part of the common tradition; and, undoubtedly, it is to be found in the earliest records of Egyptian history: but from the wonderful conformity of its outlines to the parallel doctrines of Scriptures, it is probable that it has a still higher origin, and that it constituted a part of the patriarchal or antediluvian creed, retained in a few channels, though forgotten or obliterated in others; and, consequently, that it was a divine communication in a very early age.

Putting by all traditionary information, however, there were many philosophers of Greece who attempted to reason upon the subject, and seemed desirous of abiding by the result of their own argument. Of these the principal are Socrates, Plato, and Epicurus. The first is by far the most entitled to our attention for the simplicity and clearness of his conception, and the strength of his belief. Unfortunately we have no satisfactory relic to the great chain of induction by which he was led to so correct and happy a conclusion; for we must not confound his ideas with those of Plato, who has too frequently intermixed his own with them. From the lucid and invaluable MEMORABILIA of his disciple Xenophon, however, we have historical grounds for affirming that whatever may have been the train of his reasoning, it led him to a general assurance that the human soul is allied to the Divine Being, yet not by a participation of essence, but by a similarity of nature; and hence that the existence of good men will be continued after death in a state in which they will be rewarded for their virtue. Upon the future condition of the wicked, Socrates appears to have said but little; he chiefly speaks of it as being less happy than that of the virtuous: and it has hence been conceived that, as he thought the sole hope of immortality to the good man was founded upon his becoming assimulated to the divine nature, he may have imagined that the unassimilated soul of the wicked would perish with its body; and the more so, as he allowed the same common principle or faculty of reasoning, though in a subordinate degree, to all other animals as to man; and hence again, gave sufficient proof that he did not regard this principle as necessarily incorruptible. To me, however, this opinion seems rather to have been of a contrary kind, importing future existence and punishment.

Upon this sublime subject, indeed, he appears at times to have been not altogether free from anxiety: but it is infinitely to his credit, and evinces a testimony in favour of the doctrine itself far more powerful than the force of argument, and even breathing of divine inspiration that, in his last moments, he triumphed in the persuasion of its truth, and had scarcely a doubt upon his mind. When the venerable sage, at this time in his seventieth year, took the poisoned cup to which he had been condemned by an ungrateful country, he alone stood unmoved while his friends were weeping around him: he upbraided their cowardice, and entreated them to exercise a manliness worthy of the patrons of virtue. "It would, indeed," said he, "be inexcusable in me to despise death if I were not persuaded that it will conduct me into the presence of the gods, the righteous governors of the universe, and into the society of just and good men: but I draw confidence from the hope that something of man remains after death, and that the state of the good will be much better than that of the bad." He drank the deadly cup, and shortly afterwards expired.—Such was the end of the virtuous Socrates! "A story," says Cicero, "which I never read without tears."*

The soul of the Platonic system is a much more scholastic compound than that of the Socratic; it is in truth a motley triad produced by an emanation from the Deity or Eternal Intelligence, uniting itself with some portion of the soul of the world, and some portion of matter. In his celebrated Phædo, Plato distinctly teaches, and endeavours to prove, that this compound structure had a pre-existent being, and is immortal in its own nature; and that as it did exist in a separate state antecedently to its union with the body, it will probably continue to exist in the same manner after death. There are various other arguments in favour of its immortality introduced into the same dialogue, and, like the present, derived from the different tenets of his own fanciful theory; in no respect more cogent, and only calculated for the meridian of the schools.

In the writings of Aristotle there is nothing which decisively determines whether he thought the human soul mortal or immortal; but the former is most probable from the notion he entertained concerning its nature and origin; conceiving it to be an intellectual power, externally transmitted into the human body from the eternal intelligence, the common source of rationality to human beings. Aristotle does not inform his readers what he conceived the principle, thus universally communicated, to consist of; but there is no proof that he supposed it would continue after the death of the body.†

The grand opponent of the soul's immortality, however, among the Greeks, was Epicurus. He conceived it to be a fine, elastic, sublimated, spiritualized gas or aura, composed of the most subtle parts of the atmosphere, as caloric, pure air, and vapour,‡ introduced into the system in the act of respiration, peculiarly elaborated by peculiar organs, and united with a something still lighter, still rarer, and more active than all the rest; at that time destitute of name, and incapable of sensible detection, offering a wonderful resemblance to the electric or galvanic gas of modern times. In the words of Lucretius, who has so accurately and elegantly described the whole of the Epicurean system:

> Penitus prorsum latet hæc natura, subestque;
> Nec magis hac infra quidquam est in corpore nostro;
> Atque anima est animæ proporro tutius ipsa.§
>
> Far from all vision this profoundly lurks,
> Through the whole system's utmost depth diffus'd,
> And lives as soul of e'en the soul itself.

The soul thus produced, Epicurus affirmed, must be material, because we can trace it issuing from a material source; because it exists, and exists alone in a material system; is nourished by material food; grows with the growth of the body; becomes matured with its maturity; declines with its decay; and hence, whether belonging to man or brutes, must die with its death.

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* Mem. Xen. 1. i. Nat. Deor. iii. 33. Calix venenatus qui Socratem transtulit e carcere in cœlum. Senec. Ep. 67.

† De Gen. An. ii. 3. iii. 11. Cic. Tusc. Q. i. 10. Enfield's Brucker, i. 285.

‡ In the language of Lucretius, iii. 284.

Ventus et aer
Et calor——

§ Lib. iii. 274.

But this is to suppose that every combination of matter, and every principle and quality connected with matter, are equally submitted to our senses, and equally comprehended by them. It has already appeared that we cannot determine for certain whether one or two of the principles which enters into the composition of the soul, upon this philosopher's own system, are matter, or something superior to matter, and, consequently, a distinct essence blended with it, out of the animal fabric as well as in it. Yet if they be matter, and the soul thus consists of matter, of a matter far lighter, more subtilized and active than that of the body, it does not follow that it must necessarily perish with the body. The very minute heartlet, or corcle, which every one must have noticed in the heart of a walnut, does not perish with the solid mass of the shell and kernel that encircle it: on the contrary, it survives this, and gives birth to the future plant which springs from this substance, draws hence its nourishment, and shoots higher and higher towards the heavens as the grosser materials that surround the corcle are decaying. In like manner, the decomposition of limestone, instead of destroying, sets at liberty the light gas that was imprisoned in its texture; and the gay and gaudy butterfly mounts into the skies from the dead and mouldering cerement by which it was lately surrounded. Matter is not necessarily corruptible under any form. The Epicureans themselves, as well as the best schools of modern philosophy, believed it to be solid and unchangeable in its elementary particles. Crystallized into granitic mountains, we have innumerable instances of its appearing to have resisted the united assaults of time and tempests ever since the creation of the world. And in the light and gaseous texture in which we are at present contemplating it, it is still more inseparable and difficult of decomposition. Whether material or immaterial, therefore, it does not necessarily follow, even upon the principles of this philosophy itself, that the soul must be necessarily corruptible; nor does it moreover necessarily follow that, admitting it to be incorruptible or immortal in man, it must be so in brutes. Allowing the essence to be the same, the difference of its modification, or elaboration, which this philosophy admits produces the different degrees of its perfection, may also be sufficient to produce a difference in its power of duration. And for any thing we know to the contrary, while some material bodies may be exempt from corruption, there may be some immaterial bodies that are subject to it.

The philosophers of Rome present us with nothing new; for they merely followed the dogmas of those of Greece. Cicero, though he has given us much of the opinions of other writers upon the nature and duration of the soul, has left us almost as little of his own as Aristotle has done. Upon the whole, he seems chiefly to have favoured the system of Plato. Seneca and Epictetus were avowed and zealous adherents to the principles of the Stoics; and Lucretius to those of Epicurus.

Upon the whole, philosophy seems to have made but an awkward handle of the important question before us. A loose and glimmering twilight appears to have been common to most nations; but the more men attempted to reason upon it, at least with a single exception or two, the more they doubted and became involved in difficulties. They believed and they disbelieved, they hoped and they feared, and life passed away in a state of perpetual anxiety and agitation. But this was not all: perplexed, even where they admitted the doctrine, about the will of the Deity, and the mode of securing his favour after death, with their own abstruse speculations they intermixed the religion of the multitude. They acknowledged the existence of the popular divinities: clothed them with the attributes of the Eternal; and, anxious to obtain their benediction, were punctilious in attending at their temples, and united in the sacrifices that were presented. Even Socrates, amidst the last words he uttered, desired Crito not to forget to offer for him the cock which he had vowed to Esculapius. *

In effect, the whole of the actual knowledge possessed at any time, appears to have been traditionary: for we may well doubt whether, without such a basis to have built upon, philosophy would ever have started any well-grounded opinion in favour of a future state. And this traditionary knowledge seems to have been of two kinds, and both kinds to have been delivered at a very early age of the world—the immortality of the soul, and the final resurrection of the body. From the preceding sketch it seems reasonable to suppose that both these doctrines (unquestionably beyond the reach of mere human discovery) were divinely communicated to the patriarchs; and amidst the growing wickedness of succeeding times, gradually forgotten and lost sight of: in some quarters one of them being slightly preserved, in some quarters the other, and in one or two regions, both.

In this last division it is highly probable we are to class the Hebrews at the epoch of Moses: and hence, perhaps, the reason why neither of these doctrines is specially promulgated in any part of his institutes. But in subsequent times both appear to have lost much of their force even among this people. The Pharisees and Caraites, indeed, whose opinions (whatever might be their practice) were certainly the most orthodox, supported them; but they are well known to have been both relinquished by the Sadducees, and one of them (the resurrection,) by the Essenes. Solomon, whose frequent use of Arabisms evidently betrays the elegant school in which he had chiefly studied, appears with the language to have imbibed the philosophy of the Arabian peninsula, and hence, to have admitted (in direct opposition to the Essenes, who drew their creed from India,) the doctrine of the resurrection of the body and a state of retribution, while he disbelieved the doctrine of the separate immortality of the soul: and the distinction ought to be constantly kept in view while perusing his writings, since otherwise they may appear in different places to contradict themselves. Thus, in order to confound the pomp and pageantry of the proud and the powerful, and to show them the vanity and nothingness of life, he adverts to the last of these doctrines and confines himself to it, Eccl. iii. 19, 20. "That which befalleth the sons of men befalleth beasts, even the same thing befalleth them: as the one dieth so dieth the other; yea, they have all one breath (or spirit), so that a man hath no pre-eminence above a beast, for all is vanity: all go unto one place; all are of the dust, and all turn to dust again." But when addressing himself to the young and giddy pursuer of pleasure, in order to alarm him in the midst of his gay and licentious career, he as distinctly alludes and as carefully confines himself to the first of these doctrines. His language then is, ch. xi. 9. "Rejoice, O young man, in thy youth,"

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* Xenoph. Mem. l. iv. Plat. Apol. Laert. ii.

—and tread as thou wilt the flowery paths of indulgence and pleasure; "but know thou that for all these things God will bring thee into judgment." There is an equal point, a keen and forcible moral in both addresses, and which could not fail to strike the heart of those to whom they were respectively delivered.

It has been said by some writers that the judgment here referred to relates to the present world, and must be so interpreted to avoid the self-contradiction I have just adverted to. But the wisdom of Solomon stands in no need of the feeble and rushlight illumination of such commentators; nor could it ever be so said by any critic who has diligently attended to the mixed language of Solomon's diction, or rather to the Arabisms he so frequently indulges in; and who, from this and various other sources, has traced out that his early studies must have been passed in Arabia, or under the superintendence of Arabian tutors; and who at the same time calls to mind that the Idumæan cities of Dedan and Teman had the same classical character at Jerusalem that the cities of Athens and Corinth had at Rome.

But are we still abandoned to the same unfixed and shadowy evidence, with just light enough to kindle the hope of immortality, and darkness enough to strangle it the moment it is born? Beset as the world is at all times with physical and moral evils, and doubly beset as it is at present; while virtue, patriotism, and piety are bleeding at every pore; while the sweet influences of the heavens seem turned to bitterness, the natural constellations of the zodiac to have been pulled down from their high abodes, and vice, tyranny, and atheism to have usurped their places, and from their respective ascendants, to be breathing mildew and pestilence over the pale face of the astonished earth,* is it to the worn-out traces of tradition, or the dubious fancies of philosophy, that this important doctrine is alone intrusted?—a doctrine not more vital to the hopes of man than to the justice of the Deity?—No; the fulness of the times has at length arrived: the veil of separation is drawn aside; the mighty and mysterious truth is published by a voice from heaven; it is engraved on pages of adamant, and attested by the affirmation of the godhead. It tells us, in words that cannot lie, that the soul is immortal from its birth; that the strong and inextinguishable desire we feel of future being is the true and natural impulse of a high-born and inextinguishable principle: and that the blow which prostrates the body and imprisons it in the grave, gives pinions to the soaring spirit and crowns it with freedom and triumph. But this is not all: it tells us too that gross matter itself is not necessarily corruptible: that the freedom and triumph of the soul shall hereafter be extended to the body; that this corruptible shall put on incorruption, this mortal immortality, and a glorious and beatified reunion succeed. By what means such reunion is to be accomplished, or why such separation should be necessary, we know not,—for we know not how the union was produced at first. They are mysteries that yet remain locked up in the bosom of the great Creator; and are as inscrutable to the sage as to the savage, to the philosopher as to the schoolboy; they are left, and perhaps purposely, to make a mock at all human science; and, while they form the groundwork of man's future happiness, forcibly to point out to him that his proper path to it is through the gate of humility.

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* This lecture was delivered during the period of the French Revolution.

LECTURE III.

ON HUMAN UNDERSTANDING.

Having taken a brief survey of the essence and duration of the soul, mind, or intelligent principle, as far as we have been able to collect any information upon this abstruse subject, from reason, tradition, and revelation, let us now proceed, with equal modesty and caution, to an examination into its faculties, and the mode by which they develope themselves and acquire knowledge.

"All our knowledge," observes Lord Bacon, "is derived from experience." It is a remark peculiarly characteristic of that comprehensive judgment with which this great philosopher at all times contemplated the field of nature, and which has been assumed as the common basis of every system that has since been fabricated upon the subject. "Whence," inquires Mr. Locke, "comes the mind by that vast store which the busy and boundless fancy of man has painted on it with an almost endless variety? Whence has it all the materials of reason and knowledge? I answer, in a word, from *experience*. In this all our knowledge is founded, from this the whole emanates and issues." M. Degerando, and, in short, all the French philosophers of the present day, in adopting Locke's system, have necessarily adopted this important maxim as the groundwork of their reasoning; and though, as a general principle, it has been lately called in question by a few of the ablest advocates for what they have ventured to denominate the Theory of Common Sense, and especially by Professor Stewart,* as I may perhaps find it necessary to notice more particularly hereafter, it is sufficient for the present to observe that the shrewd and learned projector of this theory, Dr. Reid, admits it in its utmost latitude: "Wise men," says he, "now agree or ought to agree in this, that *there is but one way to the knowledge of nature's works, the way of observation and experiment.* By our constitution we have a strong propensity to trace particular facts and observations to general rules, and to apply such general rules to account for other effects, or to direct us in the production of them. This procedure of the understanding is familiar to every human creature in the common affairs of life, and, IT IS THE ONLY ONE BY WHICH ANY REAL DISCOVERY IN PHILOSOPHY CAN BE MADE."†

Now, the only mode by which we can obtain experience is by the use and exercise of the senses, which have been given to us for this purpose, and which, to speak figuratively, may be regarded as the fingers of the mind in feeling its way forward, and opening the shutters to the admission of that pure and invigorating light, which in consequence breaks in upon it.

It must be obvious, however, to every one who has attended to the operations of his senses, that there never is, nor can be, any direct communication between the mind and the external objects the mind perceives, which are usually, indeed, at some distance from the sense that gives notice of them. Thus, in looking at a tree, it is the eye alone that really beholds the tree, while the mind only receives a notice of its presence, by some means or other, from the visual organ. So in touching this table, it is my hand alone that comes in contact with it, and communicates to my mind a knowledge of its hardness and other qualities. What then is the medium by which such communication is maintained which induces the mind, seated as it is in some undeveloped part of the brain, to have a correspondent perception of the form, size, colour, smell, and even distance of objects with the senses which are seated on the surface of the body: and which, at the same time that it conveys this information, produces such an additional effect that the mind is able at its option to revive the perception, or call up an exact notion or idea of these qualities at a distant period, or when the objects themselves are no longer present? Is there, or is there not, any resemblance between the external or sensible object and the internal or mental idea or notion? If there be a resemblance, in what does that resemblance consist? and how is it produced and supported? Does the external object throw off representative likenesses of itself in films, or under any other modification, so fine as to be able, like the electric or magnetic aura, to pass without injury from the object to the sentient organ, and from the sentient organ to the sensory? Or has the mind itself the faculty of producing, like a looking-glass, accurate counter-signs, intellectual pictures or images, correspondent with the sensible images communicated from the external object to the sentient organ? If, on the contrary, there be no resemblance, are the mental perceptions mere notions or intellectual symbols excited in it by the action of the external sense; which, while they bear no similitude to the qualities of the object discerned, answer the purpose of those qualities, as letters answer the purpose of sounds? Or are we sure that there is any external world whatever? any thing beyond the intellectual principle that perceives, and the sensations and notions that are perceived; or even any thing beyond those sensations and notions, those impressions and ideas themselves?

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* Philos. Essays, vol. i. p. 122.

† Inquiry into the Human Mind, p. 2.

Several of these questions may perhaps appear in no small degree whimsical and brain-sick, and more worthy of Saint Luke's than of a scientific institution. But all of them, and perhaps as many more, of a temperament as wild as the wildest, have been asked, and insisted upon, and supported again and again in different ages and countries, by philosophers of the clearest intellects in other respects, and who had no idea of labouring under any such mental infirmity, nor ever dreamed of the necessity of being blistered and taking physic.*

There is scarcely, however, a hypothesis which has been started in modern times that cannot look for its prototype or suggestion among the ancients: and it will hence be found most advantageous, and may perhaps prove the shortest way, to begin at the fountain-head, and to trace the different currents which have flowed from it. That fountain-head is Greece, or at least we may so regard it on the present occasion: and the plan which I shall request leave to pursue in the general inquiry before us will be, first of all to take a rapid sketch of the most celebrated speculations upon this subject to which this well-spring of wisdom has given rise; next, to follow up the chief ramifications which have issued from them in later periods; and lastly to summon, as by a *quo warranto*, the more prominent of those of our own day to appear personally before the bar of this enlightened tribunal, for the purpose of trying their comparative pretensions, and of submitting them to your impartial award.

The principal systems that were started among the philosophers of Greece to explain the origin and value of human knowledge were those of

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* See the Author's Study of Medicine, vol. iv. p. 46. Edit. 2. 1825.

Plato, of Aristotle, of Epicurus, and of the skeptics, especially Pyrrho and Arcesilas; and the principal systems to which they have given birth in later or modern times, are those of Des Cartes, Locke, Berkeley, Hume, Hartley, Kant, and the Scottish school of Common Sense, at the head of which we are to place Dr. Reid.

I had occasion to observe, in our first series of lectures,* that it was a dogma common to many of the Greek schools, that matter, though essentially eternal, is also, in its primal and simple state, essentially amorphous, or destitute of all form and quality whatever; and I further remarked, that the ground-work of this dogma consisted in a belief that form and quality are the contrivance of an intelligent agent; while matter, though essentially eternal, is essentially unintelligent. Matter, therefore, it was contended, cannot possibly assume one mode of form rather than another mode; for if it were capable of assuming any kind, it must have been capable of assuming every kind, and of course of exhibiting intelligent effects without an intelligent cause.

Form, then, according to the Platonic schools, in which this was principally taught, existing distinct from matter by the mere will of the Great First Cause, presented itself, from all eternity, to his wisdom or *logos*, in every possible variety; or, in other words, under an infinite multiplicity of incorporeal or intellectual patterns, exemplars, or archetypes, to which the founder of this school gave the name of *ideas;* a term that has descended without any mischief into the popular language of our own day; but which, in the hands of the schoolmen, and various other theorists, has not unfrequently been productive of egregious errors and abuses. By the union of these intellectual archetypes with the whole or with any portion of primary or incorporeal matter, matter immediately becomes embodied, assumes palpable forms, correspondent with the archetypes united with it, and is rendered an object of perception to the external senses; the mind or intelligent principle itself, however, which is an emanation from the great intelligent cause, never perceiving any thing more than the intellectual or formative ideas of objects as they are presented to the senses; and reasoning concerning them by those ideas alone.

It must be obvious, however, that the mind is possessed of many ideas which it could not derive from a material source. Such are all those that relate to abstract moral truths, and pure mathematics. And to account for these, it was a doctrine of the Platonic philosophy, that, besides the sensible world, there is also an intelligible world; that the mind of man is equally connected with both, though the latter cannot possibly be discerned by corporeal organs; and that, as the mind perceives and reasons upon sensible objects by means of sensible archetypes or ideas, so it perceives and reasons upon intelligible objects by means of intelligible ideas.

The only essential variation from this hypothesis which Aristotle appears to have introduced into his own, consists in his having clothed, if I may be allowed the expression, the naked ideas of Plato, with the actual qualities of the objects perceived; his doctrine being, that the sense, on perceiving or being excited by an external object, conveys to the mind a real resemblance of it; which, however, though possessing form, colour, and other qualities of matter, is not matter itself, but an insubstantial image, like the picture in a mirror; as though the mind itself were a kind of mirror, and had a power of reflecting the image of whatever object is presented to the external senses. This insubstantial image or picture, in order to distinguish it from the intellectual pattern or idea of Plato, he denominated a *phantasm*. And as he supported with Plato the existence of an intelligible as well as of a sensible world, it was another part of his hypothesis that, while things sensible are perceived by sensible phantasms, things intelligible are perceived by intelligible phantasms; and consequently that virtue and vice, truth and falsehood, time, space and numbers, have all their pictures and phantasms, as well as plants, houses, and animals.

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* Ser. I. Lect. II.

Epicurus admitted a part of this hypothesis, and taught it contemporaneously at Mitylene, but the greater part he openly opposed and ridiculed. He concurred in the doctrine that the mind perceives sensible objects by means of sensible images; but he contended that those images are as strictly material as the objects from which they emanate; and that, if we allow them to possess material qualities, we must necessarily allow them at the same time to possess the substance to which such qualities appertain. Epicurus, therefore, believed the perceptions of the mind to be real and substantial effigies, and to these effigies he gave the name of ειδωλα, (idola) or SPECIES, in contradistinction to the insubstantial PHANTASMS of Aristotle, and the intellectual or formative IDEAS of Plato. He maintained that all external objects are perpetually throwing off fine alternate waves of different flavours, odours, colours, shapes, and other qualities; which, by striking against their appropriate senses, excite in the senses themselves a perception of the qualities and presence of the parent object: and are immediately conveyed by the sentient channel to the chamber of the mind, or sensory, without any injury to their texture: in the same manner as heat, light, and magnetism pervade solid substances, and still retain their integrity. And he affirmed further that, instead of the existence of an imaginary, intelligible world, throwing off intelligible images, it is from the sensible or material world alone that the mind, by the exercise of its proper faculties, in union with that of the corporeal senses, derives every branch of knowledge, physical, moral, or mathematical.

If this view of the abstruse subject before us be correct, as I flatter myself it is, I may recapitulate in few words, that the external perceptions of the mind are, according to Plato, the primitive or intellectual patterns from which the forms and other qualities of objects have been taken; according to Aristotle, insubstantial pictures of them, as though reflected from a mirror; and, according to Epicurus, substantial or material effigies: such perceptions being under the first view of them denominated IDEAS; under the second, PHANTASMS; under the third, idola, or SPECIES.

While such were the fixed and promulgated tenets of Plato, Aristotle, and Epicurus, there were other philosophers of Greece, or who at least have been so denominated, that openly professed themselves to be without tenets of any kind; who declared that nothing was known or could be known upon any subject; and who, consequently, inculcated an universal skepticism. Of this delirious class of disputants, who were suffered to wander at large without a strait waistcoat, there are two that are pre-eminently entitled to our attention, Pyrrho and Arcesilas. Pyrrho studied first in the atomic school of Democritus, and seems to have lost his senses upon the question of the infinite divisibility of matter, a question which has not unfrequently given birth to the same disease in modern times. He first doubted the solidity of its elementary atoms,—he next found out, that if these be not solid, every thing slips away from the fingers in a moment—the external world becomes a mere show—and there is no truth or solidity in any thing. He was not able to prove the solidity of the elementary atoms of matter. He hence doubted of every thing; advised all the world to do the same; and established a school for the purpose of inculcating this strange doctrine. In every other respect he was a man of distinguished accomplishments, and so highly esteemed by his countrymen, as to have been honoured with the dignity of chief priest, and exempted from public taxation. But, to such a formidable extreme did this disease of skepticism carry him, that one or more of his friends, as we are gravely told in history, were obliged to accompany him wherever he went, that he might not be run over by carriages, or fall down precipices. Yet he contrived, by some means or other, to live longer than most men of caution and common sense; for we find him at last dying of a natural death, at the good old age of ninety.

Arcesilas was one of the successors to Plato in the academic chair, and founder of the school that has been known by the name of the MIDDLE ACADEMY. Plato, in his fondness for intellectual IDEAS, those creatures of his own imagination, had always given a much greater degree of credit to their testimony than to that of the objects which compose the material world; believing that the mind was less likely to be imposed upon than the external senses. And with so much zeal was this feeling or prejudice followed up by Arcesilas, that he soon began to doubt, and advised his scholars to doubt also, of the reality of every thing they saw about them; and at length terminated his doubts in questioning the competency of reason itself to decide upon any evidence the external senses might produce, though he admitted an external world of some kind or other. And upon being reminded, by one of his scholars, who had a wish to please him, that the only thing which Socrates declared he was certain of was his own *ignorance*, he immediately replied, that Socrates had no right to say even that—for that no man could be certain of any thing. It was against this unhappy madman, though in other respects, like Pyrrho, an excellent and accomplished scholar, that Lucretius directed those forcible verses in favour of the truth and testimony of the senses, as the only genuine means of acquiring knowledge, which have been so often referred to, and so warmly commended in the controversy of the present day;

> Who holds that naught is known, denies he knows
> E'en this, thus owning that he nothing knows:
> With such I ne'er could reason, who, with face
> Retorted, treads the ground just trod before.
> Yet grant e'en this he knows; since naught exists
> Of truth in things, whence learns he what to know,
> Or what not know? What things can give him first
> The notion crude of what is false or true?
> What prove aught doubtful, or of doubt devoid?
> Search, and this earliest notion thou wilt find
> Of truth and falsehood, from the senses drawn,
> Nor aught can e'er refute them; for what once,
> By truths oppos'd, their falsehood can detect,
> Must claim a trust far ampler than themselves.
> Yet what, than these, an ampler trust can claim?
> Can reason, born, forsooth, of erring sense,
> Impeach those senses whence alone it springs?
> And which, if false, itself can ne'er be true.
> Can sight correct the ears? Can ears the touch?
> Or touch the tongue's fine flavour? Or, o'er all
> Can smell triumphant rise? Absurd the thought!
> For every sense a separate function boasts,
> A power prescrib'd; and hence, or soft, or hard,
> Or hot, or cold, to its appropriate sense

Alone appeals. The gaudy train of hues,
With their light shades, appropriate thus, alike
Perceive we; tastes appropriate powers possess;
Appropriate, sounds and odours; and hence, too,
One sense another ne'er can contravene,
Nor e'en correct itself; since, every hour,
In every act, each claims an equal faith.
E'en though the mind no real cause could urge
Why what is square when present, when remote
Cylindric seems, 'twere dangerous less to adopt
A cause unsound, than rashly yield at once
All that we grasp of truth and surety most;
Rend all reliance, and root up, forlorn,
The first firm principles of life and health:
For not alone fails reason, life itself
Ends instant, if the senses thou distrust,
And dare some dangerous precipice, or aught
Against warn'd equal, spurning what is safe.
Hence all against the senses urg'd is vain;
Mere idle rant, and hollow pomp of words.
As, in a building, if the first lines err,
If aught impede the plummet, or the rule
From its just angles deviate but a hair,
The total edifice must rise untrue,
Recumbent, curv'd, o'erhanging, void of grace,
Tumbling or tumbled from this first defect,—
So must all reason prove unsound, deduc'd
From things created, if the senses err.*

It is not to be supposed that mankind could consent to be inoculated with this disease to any great extent, or for any considerable period of time; and hence the chief hypotheses that were countenanced at Rome, and till the decline of the Roman empire, were those of Plato, Aristotle, and Epicurus. During the dark ages, Aristotle seems to have held an undivided sovereignty; and, though his competitors came in for a share of power upon the revival of literature, he still held possession of the majority of the schools, till, in the middle of the seventeenth century, Des Cartes introduced a new hypothesis, which served as a foundation for most of the systems or speculations which have appeared since.

With Aristotle and Epicurus Des Cartes contended that the mind perceives external objects by images or resemblances presented to it: these images he called, after Plato, *ideas*; though he neither acceded to the meaning of this term as given by Plato, nor allowed with Aristotle or Epicurus that they proceed from the objects themselves, and are transmitted to the mind through the channel of the senses; so that the precise signification he attached to this term is not clear. With Epicurus he threw away the doctrine of an intellectual world; but contended, in order to supply its place, that the mind has a large stock of ideas of its own, implanted by the hand of nature, and not derived from the world around us: ideas, therefore, that are strictly innate, and may be found on being searched for, though otherwise not necessarily present to the mind's contemplation. Among these the principal are, the idea of thought, or consciousness, of God, and of matter; all which may be fully depended upon as so many established truths: and hence, upon his hypothesis, all real knowledge flows from an internal source, or, in other words, from the mind itself. These ideas can never deceive us, though the senses may do so in their report concerning external objects; and consequently such ideas are chiefly to be trusted to and reasoned from even in questions that relate to the senses.

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* Denique, nihil sciri si quis putat, id quoque nescit
An sciri possit, &c.—Lib. iv. 471.
The passage is too long for quotation, and the reader may easily turn to it at his leisure.

In analyzing the idea of THOUGHT, the mind, according to Aristotle, discovers it to be a power that has neither extension, figure, local motion, nor any other property commonly ascribed to body. In analyzing the idea of GOD, the mind finds presented to it a being necessarily and eternally existing, supremely intelligent, powerful, and perfect, the fountain of all goodness and truth, and the Creator of the universe. In analyzing the idea of MATTER, the mind perceives it to be a substance possessing no other property than extent:—or, in other words, as having nothing else belonging to it than length, breadth, and thickness; that space, possessing equally this property, is a part of matter, and consequently that matter is universal, and there is no vacuum. From these, and other innate ideas, compared and combined with the ideas of sensation, or those furnished to the mind by the senses, flows, on the hypothesis of Des Cartes, the whole fund of human understanding, or all the knowledge that mankind are or can be possessed of.

There are two fundamental errors, and errors, moreover, of an opposite character, that accompany, or rather introduce, this hypothesis, and to which, popular as it was at one time, it has at length completely fallen a sacrifice: these are the attempting to prove what ought to be taken for granted, and the taking for granted what ought to be proved.

The philosophy of Des Cartes sets off with supposing that every man is more or less under the influence of prejudice, and consequently that he cannot know the real truth of any thing till he has thoroughly sifted it. It follows, necessarily, as a second position, that every man ought, at least once in his life, to doubt of every thing, in order to sift it; not however, like the skeptics of Greece, that, by such examination, he may be confirmed in doubt, but that, by obtaining proofs, he may have a settled conviction.

Full fraught with these preliminary principles, our philosopher opens his career of knowledge, and while he himself continues as grave as the noble knight of La Mancha, his journey commences almost as ludicrously. His first doubt is whether he himself is alive or in being, and his next, whether any body is alive or in being about him. He soon satisfies himself however, upon the first point, by luckily finding out that he thinks, and therefore, says he gravely, I must be alive: *Cogito, ergo sum.* "I think, and therefore I am." And he almost as soon satisfies himself upon the second, by feeling with his hands about him, and finding out that he can run them against a something or a somebody else, against a man or a post. He then returns home to himself once more, overjoyed with this demonstration of his fingers; and commences a second voyage of discovery by doubting whether he knows any thing besides his own existence, and that of a something beyond him. And he now ascertains, to his inexpressible satisfaction, that the soil of his own mind is sown with indigenous ideas precisely like that of thought or consciousness. These he digs up one after another in order to examine them. One of the first that turns up is that of a God: one of the next is an idea that informs him that the outside of himself, or rather of his mind, is matter; and combining the whole he has thus far acquired with other information obtained from the same sources, he finds that the people whom he has before discovered by means of his hands and eyes call this matter a body, and that the said people have bodies of the same kind, and also the same kind of knowledge as himself, although not to the same extent or demonstration; and for this obvious reason, because they have not equally doubted and examined.

It is difficult to be grave on such a subject. What would be thought or said of any individual in the present audience who should rise up, and openly tell us that he had been long troubled with doubts whether he really existed or not; that his friends had told him he did, and he was inclined to believe so; but that as this belief might be a mere prejudice, he was at length determined to try the fact by asking himself this plain question,—"Do I think?" Is there a person before me but would exclaim, almost instinctively, "Ah! poor creature, he had better ask himself another plain question,—whether he is in his sober senses?"

If, however, we attempt to examine seriously the mode which M. Des Cartes thus proposes of following up his own principles, it is impossible not to be astonished at his departure from them at the first outset. Instead of doubting of every thing and proving every thing, the very first position before him he takes for granted: "I think; therefore I am." Of these two positions, he makes the first the proof of the second, but what is the proof of the first? If it be necessary to prove that HE IS, the very groundwork of his system renders it equally necessary to prove that HE THINKS. But this he does not attempt to do: in direct contradiction to his fundamental principles he here commits a *petitio principii*, and takes it for granted. I do not find fault with him for taking it for granted; but then he might as well have saved himself the trouble of manufacturing an imperfect syllogism, and have taken it for granted also that he was alive or that he existed, for the last fact must have been just as obvious to himself as the first, and somewhat more so to the world at large.

There is another logical error in this memorable enthymeme, or syllogism without a head, which ought not to pass without notice; I mean that the proof does not run parallel with the predicate, and consequently does not answer its purpose. The subject predicated is that the philosopher exists or is alive, and to prove this he affirms gratuitously that he thinks. "I think; and therefore I am." Now, in respect to the extent or parallelism of the proof, he might just as well have said "I itch," or "I eat; and therefore I am." I will not dispute that in all probability he thought more than he itched, or partook of food: but let us take which proof we will, it could only be a proof so long as he itched, or was eating; and consequently, whenever he ceased from either of these conditions, upon his own argument, he would have no proof whatever of being alive. Now, that he must often have ceased from itching, or eating, there is no difficulty in admitting; but then he may also at times have ceased from thinking, not only in various morbid states of the brain, but whenever he slept without dreaming. And hence, the utmost that any such argument could decide in his favour, let us take which kind of proof we will, would be that he could alternately prove himself to be alive and alternately not alive; that it was obvious to himself that he existed for and during the time that he thought, itched, or ate, but that he had no proof of existence as soon as these were over.

But I have said, that M. Des Cartes' philosophy consists not only in demanding proofs where no proofs are necessary, and where the truisms are so clear as to render it ludicrous to ask for them; but in taking for granted propositions that evidently demand proof. And I now allude to his whole doctrine of innate ideas—of axioms or principles planted in the mind by the hand of Nature herself, and which are evidently intended to supply the place of the intelligible world of Plato and Aristotle.

Of these I have only produced a small sample, and it is not necessary to bring more to market. Let us state his innate idea of a God. It is, I admit, a very reverential, correct, and perfect one, and does him credit as a theologist: but I am not at present debating with him as a theologist, but as a logician. It is in truth owing to its very perfection that I object to it; for there is strong ground to suspect, notwithstanding all his care to the contrary, that he has obtained it from induction, rather than from impulse; from an open creed, than from a latent principle. If such an idea be innate to him, there can be no question that it must be also innate to every one else. Now, it so happens that the ideas of other men, in different parts of the world, wander from his own idea as far as the north pole from the south. There are some barbarians, we are told, so benighted as to have no idea of a God at all. Such, as Mr. Marsden, His Majesty's principal chaplain in New South Wales, informs us, are the very barbarous aboriginal tribes of that vast settlement. "They have no knowledge," says he, "of any religion, false or true." There are others, whose idea of a God has only been formed in the midst of gloom and terror: and who hence, with miserable ignorance, represent him, in their wooden idols, under the ugliest and most hideous character their gross imagination can suggest. Atheism, in the strictest sense of the term, is at this moment, and has been for nearly a thousand years, at least, the established belief of the majority, or rather, of the whole Burman empire; the fundamental doctrine of whose priesthood consists in a denial that there is any such power as an eternal independent essence of the universe; and that at this moment there is any God whatever; Gaudama, their last Boodh, or deity, having, by his meritorious deeds, long since reached the supreme good of *Nigbar*, or annihilation; which is the only ultimate reward in reserve for the virtuous among mankind;* while the ideas of the wisest philosophers of Greece appear to have fallen far short of the bright exemplar of M. Des Cartes.

That Des Cartes himself was possessed of this idea at the time he wrote, no man can have any doubt; but what proof have we that he possessed it INNATELY? and that he found it among the ORIGINAL FURNITURE OF HIS MIND?

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* The most authentic account of the tenets of Boodhism which have of late years been communicated to the world, are those furnished by Mr. Judson, an American missionary, who for the last ten or twelve years has been stationary at Rangoon or Ava, has acquired an accurate knowledge of the Burman and Pali, or vulgar and sacred tongue, and has translated the whole of the New Testament into the former. His very interesting account of the mission of himself and his colleagues, as well as of the national creed of this extraordinary people, is to be found in his correspondence with the American Baptist Missionary Board, as also in "an account of the American Baptist Mission to the Burman Empire, in a Series of Letters addressed to a Gentleman in London, by A. H. Judson, 8vo. Lond. 1823." The whole universe, according to the principles of Boodhism, is governed by fate, which has no more essential existence than chance. A Boodh, or god, is occasionally produced, and appears on earth, the last of whom was Gaudama. But gods and men must equally follow the law or order of fate; they must die, and they must suffer in a future state according to the sins they have committed on earth; and, when this penance has been completed, they reach alike the supreme good of Nigbar, or utter annihilation. Gaudama, their last deity, many hundred years ago reached this state of final beatitude, and another deity is soon expected to make his appearance. An eternal self-existent being is, in the opinion of the Boodhists, an utter impossibility, and they hear of such a doctrine with horror. When Mr. Judson had obtained an audience of the Burman emperor in his palace at Ava, to solicit protection and toleration, his petition was first read and then a little tract, containing the chief doctrines of Christianity, printed in the Burman tongue, put into the Emperor's hand. "He held the tract," says Mr. Judson, "long enough to read the two first sentences, which assert that there is one eternal God, who is independent of the incidents of mortality; and that, beside him, there is no god; and then, with an air of indifference, perhaps of disdain, he dashed it down to the ground.—Our fate was decided."—Id. p. 231.

In like manner, he tells us, that his knowledge of MATTER is derived from the same unerring source; that its idea exists within him, and that this idea represents it to be an extended substance, without any other quality, and embracing space as a part of itself. Now, if such an idea appertained naturally to him, it must, in like manner, appertain naturally to every one. Let me, then, ask the audience I have the honour of addressing, whether the same notion has ever presented itself, as it necessarily ought to have done, to the minds of every one or of any one before me? and whether they seriously believe that SPACE is a part of MATTER? So far from it, that I much question whether even the meaning of the position is universally understood; while, with respect to those by whom it is understood, I have a shrewd suspicion it is not assented to; and that they would even apprehend some trick had been played upon them if they should find it in their minds. The good father Malebranche, as excellent a Cartesian as ever lived, and who possessed withal quite mysticism enough to have succeeded Plato, upon his death, and turned Xenocrates out of the chair, suspected that tricks like these are perpetually played upon us. For he openly tells us, in his *Recherche de la Vérité*, that ever since the fall Satan has been making such sad work with our senses, both external and internal, that we can only rectify ourselves by a vigorous determination to doubt of every thing, after the tried and approved Cartesian recipe: and if a man, says he, has only learned to doubt, let him not imagine that he has made an inconsiderable progress. And, for this purpose, he recommends retirement from the world, a solitary cell, and a long course of penitence and water gruel: after which our innate ideas, he tells us, will rise up before us at a glance: our senses, which were at first as honest faculties as one could desire to be acquainted with, till debauched in their adventure with original sin, will no longer be able to cheat us, we shall see into the whole process of transubstantiation, and though we behold nothing in matter, we shall behold all things in God.

It may, perhaps, be conceived that I treat the subject before us somewhat too flippantly or too cavalierly. It is not, however, the subject before us that I thus treat, but the hypothesis; and in truth it is the only mode in which I feel myself able to treat it at all; for I could as soon be serious over the 'Loves of the Plants,' or 'The Battle of the Frogs.' And I must here venture to extend the remark a little further, and to add, that there is but one hypothesis amidst all those that yet remain to be examined, that I shall be able to treat in any other manner; for, excepting in this one, there is not a whit of superiority that I can discover in any of them; and the one I refer to, though I admit its imperfections in various points, is that of our own enlightened countryman, Mr. Locke. I may, perhaps, be laughed at in my turn, and certainly should be so if I were as far over the Tweed as over the Thames, and be told that I am at least half a century behind the times. Yet, by your permission, I shall dare the laugh, and endeavour, at least, to put merriment against merriment; and shall leave it to yourselves to determine, after a full and impartial hearing, who has the best claim to be pleasant. So that the study of metaphysics may not, perhaps, appear quite so gloomy and repugnant as the writings of some philosophers would represent it. If it have its gravity, it may also be found to have its gayety as well; and to prove that there is no science in which it better becomes us to adopt the maxim of the poet, and to

> Laugh where we may, be serious where we can,
> But vindicate the ways of God to man.

LECTURE IV.

(The same subject continued.)

In our preceding study we commenced a general survey of the chief opinions and hypotheses that have been urged in different periods upon the important subject of Human Understanding; and, opening our career with the Greek schools, we closed it with that of Des Cartes.

Des Cartes, who was born in 1596, was for nearly a century the Aristotle of his age; and although from his very outset he was opposed by his contemporaries and literary friends Gassendi and Hobbes, he obtained a complete triumph, and steadily supported his ascendant, till the physical philosophy of Newton, and the metaphysical of Locke, threw an eclipse over his glory, from which he has now no chance of ever recovering.

Nothing, however, can prove more effectually the influence which fashion operates upon philosophy as well as upon dress, than a glance at the very opposite characters by whom the Cartesian system was at one and the same time principally professed and defended—Malebranche and Spinosa, Leibnitz and Bayle. It would, perhaps, be impossible, were we to range through the whole scope of philosophical or even of literary biography, to collect a more motley or heterogeneous group; the four elements of hot, cold, moist, and dry, cannot possibly present a stronger contrast; a mystical Catholic, a Jewish materialist, a speculative but steady Lutheran, and an universal skeptic.

It was only, however, for want of a simpler and more rational system, that Des Cartes continued so long and so extensively to govern the metaphysical taste of the day. That system was at length given to the world by Mr. Locke, and the "PRINCIPIA PHILOSOPHIÆ" fell prostrate before the "ESSAY CONCERNING HUMAN UNDERSTANDING."

This imperishable work made its first appearance in 1689: it may, perhaps, be somewhat too long; it may occasionally embrace subjects which are not necessarily connected with it; its terms may not always be precise, nor its opinions in every instance correct; but it discovers intrinsic and most convincing evidence that the man who wrote it must have had a head peculiarly clear and a heart peculiarly sound. It is strictly original in its matter, highly important in its subject, luminous and forcible in its argument, perspicuous in its style, and comprehensive in its scope. It steers equally clear of all former systems: we have nothing of the mystical archetypes of Plato, the incoporeal phantasms of Aristotle, or the material species of Epicurus; we are equally without the intelligible world of the Greek schools, and the innate ideas of Des Cartes. Passing by all which, from actual experience and observation it delineates the features, and describes the operations of the human mind, with a degree of precision and minuteness which have never been exhibited either before or since.* "Nothing," says Dr. Beattie, and I readily avail myself of the acknowledgment of an honest and enlightened antagonist, "was further from the intention of Locke, than to encourage verbal controversy, or to advance doctrines favourable to skepticism. To do good to mankind by enforcing virtue, illustrating truth, and vindicating liberty, was his sincere purpose.

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* Stud of Med. Vol. iii. p. 49. 2d edit.

His writings are to be reckoned among the few books that have been productive of real utility to mankind."*

To take this work as a text-book, of which, however, it is well worthy, would require a long life instead of a short lecture : and I shall, hence, beg leave to submit to you only a very brief summary of the more important part of its system and of the more prominent opinions it inculcates, especially in respect to the powers and process of the mind in acquiring knowledge. The work consists of four divisions, the first of which, however, is merely introductory, and intended to clear the ground of that multitude of strong and deep-rooted weeds at which we have already glanced, and which, under the scholastic name of *præcognita*, innate ideas, maxims, and dictates, or innate speculative and practical principles, prevented the growth of a better harvest ; and, to a certain extent, superseded the necessity of reason, education, and revelation, of national institutions and Bible societies ; by teaching that a true and correct notion of God, of self or consciousness, of virtue and vice, and consequently of religious and moral duties, is imprinted by nature on the mind of every man ; and that we cannot transgress the law thus originally implanted within us without exposing ourselves to the lash of our own consciences. Discarding for ever all this jargon of the schools, the Essay before us proceeds in its three remaining parts to treat of IDEAS, which, in the popular, and not the scholastic sense of the term, are the elements of knowledge ; of WORDS, which are the signs of ideas, and consequently the circulating medium of knowledge ; and of KNOWLEDGE itself, which is the subject proposed and the great end to be acquired.

The whole of the preceding rubbish, then, being in this manner cleared away, the elaborate author proceeds to represent to us the body and mind as equally at birth a *tabula rasa*, or unwritten sheet of paper, as consisting equally of a blank or vacuity of impressions, but as equally capable of acquiring impressions by the operation of external objects, and equally and most skilfully endowed with distinct powers or faculties for this purpose ; those of the body being the external senses of sight, hearing, smell, taste, and touch ; and those of the mind the internal senses of perception, reason, judgment, imagination, and memory.†

It is possible that a few slight impressions may be produced a short time antecedently to birth ; and it is certain that various instinctive tendencies, which, however, have no connexion with the mind, are more perfect, because more needful, at the period of birth than ever afterwards ; and we have also frequent proofs of an hereditary or accidental predisposition towards particular subjects. But the fundamental doctrine before us is by no means affected by such collateral circumstances ; to the correctness of which our most eminent logicians of later times have given their entire suffrage. Thus Bishop Butler, and it is not necessary to go farther than this eminent casuist :—" In these respects," meaning those before us, " mankind is left by nature an unformed, unfinished creature, utterly deficient and unqualified before the acquirement of knowledge, experience, and habits, for that mature state of life which was the end of his creation, considering him as related only to this world. The faculty of reason is the candle of the Lord within us ; though it can afford no light where it does not shine, nor judge where it has no principles to judge upon."[*]

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* Essay on Truth, Part ii. ch. ii. § 2.

† An abstract of this view of Mr. Locke's system, abbreviated for the occasion, the Author found himself called upon to introduce into his Study of Medicine.—Vol. iv. p. 50—55. 2d edit. 1825.

External objects first impress or operate upon the outward senses, and these senses, by means hitherto unexplained, and, perhaps, altogether inexplicable, immediately impress or operate upon the mind, or excite in it perceptions or ideas of the presence and qualities of such objects; the word idea being employed in the system before us, not as we have already hinted at, in any of the significations of the schools, but in its broad and popular meaning, as importing "whatever a man observes and is conscious to himself he has in his mind;"[†] whatever was formerly intended by the terms archetype, phantasm, species, thought, notion, conception, or whatever else it may be, which we can be employed about in thinking.[‡] And to these effects, without puzzling himself with the inquiry how external objects operate upon the senses, or the senses upon the mind, Mr. Locke gave the name of *ideas of* SENSATION, in allusion to the source from which they are derived.

But the mind, as we have already observed, has various powers or faculties as well as the body; and they are quite as active and lively in their respective functions. In consequence of which the ideas of external objects are not only perceived, but retained, thought of, compared, compounded, abstracted, doubted, believed, desired; and hence another fountain, and of a very capacious flow, from which we also derive ideas, namely, a reflex act or perception of the mind's own operations; whence the ideas derived from this fountain are denominated *ideas of* REFLEXION. The ideas, then, derived from these two sources, and which have sometimes been called OBJECTIVE AND SUBJECTIVE,[§] constitute all our experience, and consequently all our knowledge. Whatever stock of information a man may be possest of, however richly he may be stored with taste, learning, or science, if he turn his attention inwards and diligently examine his own thoughts, he will find that he has not a single idea in his mind but what has been derived from the one or the other of these two channels. But let not this important observation be forgotten by any one; that the ideas the mind possesses will be fewer or more numerous, simpler or more diversified, clear or confused, according to the number of the objects or subjects presented to it, and the extent of its reflection and examination. Thus, a clock or a landscape may be for ever before our eyes, but unless we direct our attention to them, and study their different parts, although we cannot be deceived in their being a clock or a landscape, we can have but a very confused idea of their character and composition. The ideas presented to the mind, from which of these two sources soever derived, or in other words, whether objective or subjective, are of two kinds, SIMPLE and COMPLEX.

[*] Analogy of Religion, Natural and Revealed, Part i. ch. v. Part ii. Conclusion.

[†] Locke, Book i. ch. i. § 3.

[‡] Ib. § 8.

[§] "On appelle, dans la philosophie Allemande, idees *subjectives* celles que naissent de la nature de notre intelligence et de ses facultes, et idees *objectives* toutes celles que sont excitees par les sensations."—Mad. de Stael Holstein, de l'Allemagne, tom. iii. p. 76.

Mad. de Stael, however, has fallen into the common error of the French philosophers, from whom she appears to have generally informed herself of the principles of Locke's system, in supposing that he derived all ideas from sensation. "A l'epoque ou parut *la Critique de la Raison pure*, il n'existoit que deux systemes sur l'entendement humain parmi les penseurs; l'une, celui de Locke, *attribuoit toutes nos idees a nos sensations;* l'autre, celui de Descartes et de Leibnitz, s'attachoit a demontrer la spiritualite et l'activite de l'ame, de libre arbitre, enfin toute la doctrine idealiste."—Id. p. 70.

SIMPLE IDEAS consist of such as are limited to a single notion or perception; as those of unity, darkness, light, sound, hardness, sweetness, simple pain or uneasiness. And in the reception of these the mind is passive, for it can neither make them to itself, nor can it, in any instance, have any idea which does not wholly consist of them: or, in other words, it cannot contemplate any one of them otherwise than in its totality. Thus, on looking at this single sheet of paper, I have the idea of unity; and though I may divide the single sheet of paper into twenty parts, I cannot divide the idea of unity into twenty parts; for the idea of unity will and must as wholly accompany every part as it accompanies the collective sheet. And the same remark will apply to all the rest.

COMPLEX IDEAS are formed out of various simple ideas associated together, or contemplated derivatively. And to this class belong the ideas of an army, a battle, a triangle, gratitude, veneration, gold, silver, an apple, an orange: in the formation of all which it must be obvious that the mind is active, for it is the activity of the mind alone that produces the complexity out of such ideas as are simple. And that the ideas I have now referred to are complex must be plain to every one; for every one must be sensible that the mind cannot form to itself the idea of an orange without uniting into one aggregate the simple ideas of roundness, yellowness, juiciness, and sweetness. In like manner, in contemplating the idea of gold, there must necessarily be present to the mind, and in a complex or aggregate form, the ideas of great weight, solidity, yellowness, lustre; and if the idea be very accurate, great malleability and fusibility.

Complex ideas are formed out of simple ideas by many operations of the mind; the principal of which, however, are some combination of them, some abstraction, or some comparison. Let us take a view of each of these:—

And, first, of complex ideas of COMBINATION. Unity, as I have already observed, is a simple idea; and it is one of the most common simple ideas that can be presented to the mind, for every object without, and every idea within, tend equally to excite it. And, as being a simple idea, the mind, as I have also remarked, is passive on its presentation; it can neither form such an idea to itself, nor contemplate it otherwise than in its totality; but it can combine the ideas of as many units as it pleases, and hence produce the complex idea of a hundred, a thousand, or a hundred thousand. So beauty is a complex idea, for the mind, in forming it, combines a variety of separate ideas, into one common aggregate. Thus Dryden, in delineating the beautiful Victoria, in his "Love Triumphant:"

> Her eyes, her lips, her cheeks, her shape, her features,
> Seem to be drawn by LOVE's own hand; by LOVE
> Himself in love.

In like manner the mind can produce complex ideas by an opposite process, and that is, by ABSTRACTION, or separation. Thus chalk, snow, and milk, though agreeing, perhaps, in no other respect, coincide in the same colour; and the mind, contemplating this agreement, may abstract or separate it from the other properties of these three objects, and form the idea which is indicated by the term *whiteness;* and having thus acquired a new idea by the process of abstraction, it may afterwards apply it as a character to a variety of other objects : and hence particular ideas become general or universal.

Other complex ideas are produced by COMPARISON. Thus, if the mind take one idea, as that of a foot, as a determinate measure, and place it by the side of another idea, as the idea of a table, the result will be a formation of the complex idea of length, breadth, and thickness. Or if we vary the primary ideas, we may obtain as a result, the secondary ideas of coarseness and fineness.

And hence complex ideas must be almost infinitely more numerous than simple ideas, which are their elements or materials, as words must be always far more numerous than letters. I have instanced only a few of their principal kinds ; but even each of these kinds is applicable to a variety of subjects, of which Mr. Locke mentions the three following :

I. IDEAS of SUBSTANCES ; or such as we have uniformly found connected in the same thing, and without which, therefore, such thing cannot be contemplated. To this head belong the complex ideas of a man, a horse, a river, a mountain.

II. IDEAS of MODES ; or such as may be considered as representative of the mere affections, or properties of substance ; of which the idea of number may once more be offered as an example : the ideas of expansion or extension and duration belong to the same stock ; and in like manner those of power, time, space, and infinity, which are all modes, properties, or affections of substance ; or secondary ideas derived from or excited by the primary idea of substance of some kind or other.

III. IDEAS of RELATIONS ; which are by far the most extensive, if not the most important, branch of subjects from which our complex ideas are derived ; for there is nothing whatever, whether simple idea, substance, mode, relation, or even the name of any of them, which is not capable of an almost infinite number of bearings in reference or relation to other things. It is from this source, therefore, that we derive a very large proportion of our thoughts and words. As examples under it, I may mention all those ideas that relate to, or are even imported by the terms father, brother, son, master, magistrate, younger, older, cause and effect, right and wrong, and consequently all moral relations.

It must hence appear obvious that many of our ideas have a NATURAL CORRESPONDENCE, congruity, and connexion with each other. And as many, perhaps, on the contrary, a NATURAL REPUGNANCY, incongruity, and disconnexion. Thus if I were to speak of a cold fire, I should put together ideas that are naturally disconnected and incongruous, and should consequently make an absurd proposition, or, to adopt common language, talk nonsense. I should be guilty of the same blunder if I were to speak of a square billiard ball, or a soft reposing rock. But a warm fire, on the contrary, a white, or even a black billiard ball, and a hard, rugged rock, are congruous ideas, and consequently consistent with good sense. Now it is the direct office of that discursive faculty of the mind which we call reason, to trace out these natural coincidences or disjunctions, and to connect or separate them by proper relations. For it is a just perception of the natural connexion and congruity, or of the natural repugnancy and incongruity of our ideas, that constitutes all real knowledge. The wise man is he who has industriously laid in and carefully assorted an extensive stock of ideas ; as the stupid or ignorant man is he who, from natural hebetude, or having had but few opportunities, has collected and arranged but a small number. The man who discovers the natural relations of his ideas quickly is a man of sagacity; and, in popular language, is said, and correctly so, to possess a quick, sharp intellect. The man, on the contrary, who discovers these relations slowly, we call dull or heavy. If he rapidly discover and put together relations that lie remote, and perhaps touch only in a few points, but those points striking and pleasant, he is a man of wit, genius, or brilliant fancy; of agreeable allusion and metaphor. If he connect ideas of fancy with ideas of reality, and mistake the one for the other, however numerous his ideas may be, and whatever their organ of succession, he is a madman: he reasons from false principles; and, as we say in popular language, and with perfect correctness, is out of his judgment.

Finally, our ideas are very apt to ASSOCIATE or run together in trains; and upon this peculiar and happy disposition of the mind, we lay our chief dependence in sowing the important seeds of education. It often happens, however, that some of our ideas have been associated erroneously, and even in a state of early life, before education has commenced: and hence, from the difficulty of separating them, most of the sympathies and antipathies, the whims and prejudices that occasionally haunt us to the latest period of old age. Peter the Great, having been terrified by a fall into a sheet of water when an infant, could never, till he became a man, go over a bridge without shuddering; and even at last had no small difficulty in breaking the connexion of the ideas that were thus early and powerfully associated. Avarice did not by any kind of predisposition belong to the miser Elwes, for in his youth he was of gay manners, and a spendthrift; but he caught the vice by living with his uncle: uninterrupted habit, the strong power of association, gave strength to its influence, and what was originally his abhorrence, became at length his idol.

Such, then, is the manner in which the mind, at first a sheet of white paper, without characters of any kind, becomes furnished with that vast store of ideas, the materials of wisdom and knowledge, which the busy and boundless fancy of man has painted on it with an almost endless variety. The whole is derived from experience—THE EXPERIENCE OF SENSATION OR REFLECTION; from the observations of the mind employed either about external sensible objects, or the internal operations of itself, perceived and reflected upon by its own faculties.

But man is a social as well as a rational being; he is dependent for the supply of his wants upon his fellow man; and his happiness is made to consist in this dependence. The ideas he possesses he feels a desire of communicating, and those possessed by others he feels an equal desire of diving into. But ideas in themselves are incommunicable; he requires here, as in the case of sensible objects, a circulating medium by which their value may be expressed. And what he requires is freely granted to him: it consists in the high faculty of speech; in reducing ideas to articulate sounds or words, the aggregate of which constitutes language. And hence the great and valuable systematic work to which I have now chiefly directed your attention, proceeds from a general analysis of our ideas to a general analysis of their vocal representatives: a subject which every one must perceive to be of the utmost importance in the progress of human understanding. Important, however, as it is, it is a subject rather collateral than direct. We have briefly glanced at it already,* and may perhaps return to it hereafter, but I shall postpone it for the present, that we may hasten with due speed to the goal before us. Allow me, however, before we quit it, to observe that words bear precisely the same relation to ideas that ideas do to objects; for as ideas are the mere signs of objects, so words are the mere signs of ideas; and hence that every rule which applies to the variety, precision, and arrangement of our ideas, applies with equal force to the variety, precision, and arrangement of our words; and that without a clear and determinate meaning to the latter, we can no more have a clear and determinate apprehension of the former than we can have of a person's features by a confused or unlike picture. And hence the importance of attending to our vocabulary; of minutely measuring and weighing the terms we make use of, so as to adjust them exactly to the measure and weight of our ideas, must be obvious at the first glance; as it must be also, that the more exact and copious a language is found, the more clear and comprehensive must be the general knowledge of the nation to which it belongs.

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* Ser. II. Lect. VIII. IX. X.

But ideas and words, though the materials of which knowledge is constructed, and without which it cannot among mankind be constructed at all, are no more knowledge itself, than the bricks and mortar of a house are the house itself. Both, as I have indeed hinted at already, must be collected in sufficient abundance, compared with each other, duly assorted, arranged and united together, before the proper building can be produced; and we have yet, therefore, to contemplate the most important part of the subject before us, and that to which the preceding parts are subservient—the general nature of knowledge, its kinds, degrees and reality.

KNOWLEDGE may be defined the PERCEPTION OF TRUTH, or in the language of Aristotle, THE SCIENCE OF TRUTH: and consequently he who acquires knowledge, perceives or acquires truth. But what is truth? This is a question which has been asked for ages: the particular answer, however, must necessarily depend upon the particular subject to which it refers. We are now considering *general truth*, which may be defined the connexion and agreement, or repugnancy and disagreement, of our ideas.

This definition requires some attention; but when it is thoroughly comprehended, it will be found to apply to truths of every kind, in the arts, physics, and morals, as well as in metaphysics; for the law of adjustment, of connexion and disconnexion, of congruity and incongruity it refers to, is an universal law or constitution of nature, and hence must hold equally every where. Thus in a building, where the different parts of which it consists perfectly agree, the lines accurately correspond, and the dependencies fit and are proportioned to each other; every part is TRUE to every part, and the whole is true to itself.

So in working a mathematical problem, or determining a fact from circumstantial evidence, every separate link or idea that constitutes a part of the general chain, must have its proper connexion or agreement with the link or idea that lies next to it, as well above as below; for it is these connexions or agreements between one idea and another that constitute the proofs, and a failure in any one destroys our knowledge upon the subject; or, in other words, prevents us from perceiving its truth.

It sometimes happens, that we are able to discover at once, this agreement or disagreement, this connexion or repugnancy, in the ideas that are presented to us; and in such case our knowledge is instantaneous, and constitutes what we call INTUITION OR INTUITIVE KNOWLEDGE. But if happens far more generally that the agreement or disagreement is by no means obvious; and we are obliged, as in the case of circumstantial evidence, to look out for some intermediate idea, which the schools denominate a *medius terminus*, by which the separate ideas may be united. To make this research is the peculiar province of the discursive faculty of reason; and hence the information thus obtained is called RATIONAL KNOWLEDGE.

Let us take a brief view of both these. When I affirm that white is not black; or, which is a proposition of the same kind, that white is white, and black is black, I affirm what I know intuitively. The colours of white and of black, have excited ideas in my mind, which, whenever they occur, must be identic and true to themselves; for it is not possible for me to have any other idea of white than white, or of black than black: the agreement in this case is the AGREEMENT OF IDENTITY, the agreement of either idea with itself: and hence the man who asks me to prove that white is white, or that white is not black, or red, or yellow, asks me to prove what I neither can prove nor want to prove. I do not want to prove it, for I know it with certain knowledge, or, in other words, it is SELF-EVIDENT. And I cannot prove it for this reason: that every proof consists in placing between two ideas that we want to unite together by an agreement which we do not perceive, an idea whose agreement with both of them is more obvious. But what idea can I place by the side of the idea of white, of black, of red, or of yellow, that can agree more fully with either of these ideas, than such ideas agree with themselves? Every one must see that there is no such idea to be had; and consequently that I can neither offer a proof nor want one. And the very attempt to obtain such a proof would be an absurdity; for could it possibly be acquired, it would not add to my knowledge, which is perfect and certain already, and depends upon the constant agreement of the idea with itself,—the agreement of identity.

Nothing has been productive of more mischief in the science of metaphysics than this absurd restlessness in seeking after proofs in cases of intuition, where no proofs are to be had, and the knowledge is certain without them. M. des Cartes' hypothesis, as I had occasion to notice in our last lecture, commences with an instance of this very absurdity, and it has proved the ruin of it; and the same attempt in various other hypotheses of later date that we shall yet have to touch upon, and particularly those of Bishop Berkeley and Mr. Hume, has equally proved the ruin of these. When I affirm that *I am*, I affirm that of which I have an intuitive knowledge: and when I affirm that *I think*, I only make a proposition of the same kind. The connexion between the two ideas, *I am*, and the two ideas *I think*, is a connexion of co-existence or absolute necessity. It is not possible to separate them, and they want no third or intervening idea to unite them; for if it were possible for me to doubt whether I thought, or whether I existed, the very doubt itself would answer the purpose of a proof in either case. Now one of the chief absurdities of M. des Cartes' argument, *I think, therefore I am*, consists in his putting two propositions equally self-evident and intuitive, by the side of each other, and making the first the proof of the second. For being equally intuitive, the second must be just as good a proof of the first as the first is of the second; since the mind can no more put together the two ideas *I am* without *thinking*, than it can put together the two ideas *I think*, without *being*. But nothing is gained by their being put together in the way of proof or demonstration, for I have no more evidence of my existence by calling up the ideas, *I think*, than I have before this proposition was conceived. And hence the attempt not only fails, but could lead to no use if it could stand its ground.

Our knowledge of personal identity is derived from the same source. It is INTUITIVE. This is a subject which has excited a great deal of learned controversy,—and called forth many a different proof, or attempt at proof, from the different disputants who have engaged in it. Mr. Locke himself, with a singular deviation from the principles of his own system, has fallen into a common error, and offered as a proof the idea of consciousness. No proof, however, or attempt at proof, is more imperfect; for the identity often continues when the consciousness is interrupted, as in sleep without dreaming, in apoplexy, catalepsy, drowning, and various other cases; and hence if identity were dependent on consciousness, the same man in a dead sleep and out of it would be two or more different persons. The truth is, that our knowledge of identity is intuitive; the two ideas, *I am*, and the two ideas *I was*, a combination of which constitutes the more complex idea of personal identity, are ideas of necessary connexion from the first moment the connexion can be formed; and hence they produce certain knowledge, and can have no proof; since there can be no intermediate idea capable of possessing a closer connexion with either proposition, and consequently fitted to enter between them. "Here then," to adopt the language of Bishop Butler, whose reasoning upon this subject bears a close resemblance to the present, "we can go no further. For it is ridiculous to attempt to prove the truth of those perceptions, whose truth we can no otherwise prove than by other perceptions of exactly the same kind with them, and which there is just the same ground to suspect: or to attempt to prove the truth of our faculties, which can no otherwise be proved than by the use or means of those very suspected faculties themselves."*

I may now advance a step further, and observe that in all cases in which the agreement or disagreement of two or more ideas can be immediately perceived and compared together, our knowledge is of a like kind, and consequently approaches to intuitive; although to other persons such ideas may be very remote, and require a long chain of intermediate ideas to connect or separate them, or prove their agreement or repugnancy. Thus I know intuitively, or without going through the process, that the arc of a circle is less than the entire circle; that a circle itself is a line equi-distant in every part of it from its centre; that the three angles of a triangle are equal to two right angles; that the square of four is sixteen. No man, however, can perhaps have any kind of knowledge at first sight upon any of these subjects; he cannot put the extreme ideas together in such a manner as to perceive their agreement or disagreement, and he is not acquainted with the intermediate ideas which are to compare them, and prove their relation. If he could perceive that relation at first sight, he would at first sight have intuitive knowledge upon the subject: and some persons have a much more comprehensive power of this kind than others; for they can perceive and compare the relations of ideas both more readily and more extensively. Euler was a striking example of this endowment, in regard to the science of abstract quantities; Jedediah Buxton appears to have obtained a similar degree of intuitive knowledge in regard to the science of numbers; and we seem in our own day to have another instance of the same kind in the very extraordinary young calculator from America, not more than eight years old.*

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* Analogy of Religion, Natural and Revealed. Of Personal Identity, forming Diss. I.

I have already stated, that when we cannot immediately perceive the agreement or disagreement of two or more ideas, which we are desirous of bringing into comparison, we are obliged to seek out for some intervening idea whose agreement or disagreement with them is obvious to us; and I have also stated, that as this general search is the immediate office of the faculty of reason, the knowledge thus obtained is called RATIONAL KNOWLEDGE. In many cases we are so fortunate as to hit upon intervening ideas whose connexion with the one, the other, or both, as in a chain of perfect evidence, is clear and distinct; and in such case, whether the reasoning consist of a single step or of many, as soon as the mind is able to perceive the connexion or repugnancy, the agreement or disagreement of the ideas in question, the degree of rational knowledge hereby obtained becomes equal or nearly so to INTUITION, and is called DEMONSTRATION. If the proofs or intervening ideas do not quite amount to this, we have necessarily an inferior degree of rational knowledge, and we distinguish it by the name of BELIEF, ASSENT, or OPINION; and according to the nature of the proofs or intermediate ideas, as decided by the faculty of the judgment, the opinion is rendered INDUBITABLE, PROBABLE, CONJECTURAL, or SUSPICIOUS.

It is upon this comparison of two ideas, by means of a mediate idea expressed or understood, that most of our moral information or common knowledge would be found to depend, if we were to analyze it. Thus, on going into the street, and hearing a man whom I am acquainted with, asking which is the way to London Bridge, I may perhaps observe to a bystander, "that man ought to know the way." The bystander immediately compares the two ideas of going to London Bridge, and the man's right to know the way, but can find no connexion or agreement between them, and consequently is ignorant of what I mean. He applies to me therefore, for the intermediate idea by the question "Why so?" and I give it to him by answering, "Because he has repeatedly been the same road before:" and although he does not put the three ideas into the measured form of the schools, which is called a syllogism, every one as regularly passes through his mind, and gives him the same satisfactory information as if they were to assume such order: in which case they would perhaps run as follows:

> Every man who goes repeatedly the same road should know his way:
> This man has been repeatedly the same road:
> Therefore this man should know his way.

It would be absurd to introduce this part of logical analysis into common discourse: but it is of high use in the closet, as teaching us precision, by compelling us to measure the force and value of every idea and word of which a proposition consists. We are indebted to Aristotle for its invention; and though it was at one time carried to an absurd excess, it has of late years been far too generally discontinued.

The connective or intermediate idea is not always expressed either in speaking or writing; and hence is not always obvious to the hearer or reader, though it is, or ought to be, so to the framer of the argument. Let me exercise the ingenuity of the audience before me by throwing out as a trial, the following well-known sentiment of Mr. Pope:

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* See "Some account of Zerah Colburn, an American child, who possesses some very remarkable powers of solving questions in arithmetic, by computation, without writing, or any visible contrivance."—Nicholson's Journal of Nat. Phil. vol. xxxiv. p. 5.

> Who governs freemen should himself be free.

Here are two distinct propositions: and Dr. Johnson, not immediately perceiving their agreement, nor immediately hitting upon any intervening idea or proposition by which they might be united, declared the whole to be a riddle, and that the poet might just as well have written,

> Who drives fat oxen should himself be fat.

Had Johnson, however, lived in our own day, and turned his attention to the Continent, it would have been a riddle to him no longer; for he would have called to mind, as I doubt not every one before me has done already, the mischief that has happened to many a free people on the Continent, from the unfortunate want of freedom in the sovereign who is placed over them, and his being under the detestable control of one of the worst, and, unluckily, one of the most universal, tyrants, the world has ever witnessed.* He would have been, as every one before me must be, at once prepared to have connected the two ideas of *free men*,—and the propriety of their being governed by *a free sovereign*, by means of a third or intervening idea to this effect, that otherwise the people themselves might run no small risk of having their freedom destroyed by foreign force; the whole of which might assume the following appearance if reduced to the form of a syllogism:

> Who governs free-men should be able to maintain their freedom:
> But he who is not free himself is not able to maintain their freedom:

Therefore,

> Who governs freemen should himself be free.

Proper or real knowledge, then, is of two kinds or degrees, Intuition and demonstration; below which, all the information we possess is imperfect knowledge or opinion. Mr. Locke, nevertheless, out of courtesy to the Cartesian hypothesis, rather than from any other cause, makes proper or real knowledge to consist of three degrees, placing sensible knowledge, or that obtained by an exercise of the external senses, below the two degrees of intuition and demonstration, though above the authority of opinion. In most instances, however, the ideas we obtain from the senses are as clear and as identic as those obtained from any other source; and in all such cases the knowledge they produce is self-evident or intuitive. And although, at times, the idea excited by a single sense may not be perfectly clear, yet, as we usually correct it, or destroy the doubt which accompanies it by having recourse to another sense, which furnishes us with the proof or intermediate idea, the knowledge obtained, even in these cases, though not amounting to intuition, is of the nature of demonstration: whence all sensible knowledge (the organs of sense being in themselves perfect, and the objects fully within their scope,) falls, if I mistake not, under the one or the other of these two divisions.

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* Napoleon Buonaparte. This lecture was delivered in 1814.

Demonstrative knowledge, where the intervening proofs or ideas perform their part perfectly, approaches, as I have already observed, to the certainty of intuition. But it has generally been held that this kind of demonstration can only take place in the science of mathematics, or, in other words, in ideas of number, extension, and figure. I coincide, however, completely with Mr. Locke, in believing that the knowledge afforded by physics may not unfrequently be as certain. I have already stated that the knowledge we possess of our own existence is intuitive. Our knowledge of the existence of a God is, on the contrary, demonstrative. Examine, then, the proofs of this latter knowledge, and see whether it be less certain. Am I asked where proofs to this effect are to be found? On every side they press upon us in clusters.—I cannot, indeed, follow them up at the present moment, for it would require a folio volume, instead of the close of a single lecture; and I merely throw out the hint that you may pursue it at home. But this I may venture to say, that whatever cluster we take, it will develope to us a certain proof, and in its separate value, fall but little short of the force of self-evidence. If I ascend into heaven, he is there; in peerless splendour, in ineffable majesty; diffusing, from an inexhaustible fountain, the mighty tide of light, and life, and love, from world to world, and from system to system. If I descend into the grave, he is there also; still actively and manifestly employed in the same benevolent pursuit; still, though in a different manner, promoting the calm but unceasing career of vitality and happiness; harmoniously leading on the silent circle of decomposition and re-organization; fructifying the cold and gloomy regions of the tomb; rendering death itself the mysterious source of reproduction and new existence; and thus literally making the " dry bones live," and the " dead sing praises" to his name. If I examine the world without me, or the world within me, I trace him equally to a demonstration:—I feel,—nay, more than *feel*,—I *know* him to be eternal, omniscient, omnipotent, the Creator of all things, and therefore God. I discover him, not by the vain maxims of tradition, or the visionary conceit of innate principles, but by the faculty with which he has expressly endowed me to search for him,—by my reason. There may, perhaps, be some persons, as well learned as unlearned, who have never brought together these proofs of his existence, and are therefore ignorant of him; as there certainly are others, who have never brought together the proofs that the three angles of a triangle are equal to two right angles, and are therefore ignorant of geometry: but both facts have a like truth and a like foundation; both flow from and return to the same fountain; for God is the author of every truth,—for God is truth itself.

LECTURE V.

ON ANCIENT AND MODERN SKEPTICS.

From a system that is simple, intelligible, and satisfactory, adapted to the condition of man, and pregnant with useful instruction, we have now to turn our attention to a variety of hypotheses, that are scarcely in any instance worthy of the name of systems, and which it is difficult to describe otherwise than by reversing the terms we have just employed, and characterizing them as complicated, unintelligible, unsatisfactory; as not adapted to the condition of man, and barren of useful instruction.

It is a distinguishing and praiseworthy feature in the Essay on Human Understanding, that it confines itself to the subject of human understanding alone, and that in delineating the operations of the mind, it neither enters into the question of the substance of mind, or the substance of matter; neither amuses us with speculations how external objects communicate with the senses, or the senses with the mental organ. It builds altogether upon the sure foundation of the simple fact, that the senses are influenced, and that they influence the mind; and as, in the former case, it calls the cause of this influence external objects, so in the latter case it calls the effects it produces internal ideas. Of the nature of these objects it says little, but of their substantive existence; of the nature of these ideas it says little, but of their truth or exact correspondence with the objects that excite them; its general view of the subject being reducible to the two following propositions:—

First, that as objects are perceivable at a distance, and bodies cannot act where they are not, it is evident that something must proceed from them to produce impulse upon the senses, and that the motion hereby excited, may be thence continued by the nerves, or connecting chain, to the brain or seat of sensation, so as to produce in our minds the particular ideas we have of them.*

And, secondly, that the ideas thus produced, so far from being images or pictures of the objects they represent, have no kind of resemblance to them, except so far as relates to their real qualities of solidity, extension, figure, motion, or rest and number.†

Thus far, and thus far only, does the author of the Essay on Human Understanding indulge in a digression into physical science; and even for this he feels it necessary to offer an apology to his reader: "I hope," says he, "I shall be pardoned this little excursion into natural philosophy, it being necessary in our present inquiry."‡

For myself I am glad he did not proceed farther, and should have been still more satisfied if he had not proceeded even so far; for the subject proves itself, even in his hands, to be inexplicable; and if he be here found to evince some degree of obscurity, it is only, perhaps, because it is not possible to avoid it. Of the PRIMARY or real qualities of bodies, as he denominates them, we know but little; and it is probable that Mr. Locke has enumerated one or two under this head that do not properly belong to the list. And although it is not difficult to determine his meaning where he asserts that their ideas resemble them, as being drawn from patterns existing in the bodies themselves, the sense of the passage has been very generally mistaken, and opinions have hence been ascribed to him which are contrary to the whole tenor of his system. In consequence of being real representatives, of real qualities, they resemble them in respect to REALITY. And this, I think, seems to be what Mr. Locke intended to express upon this subject; though he does not discover his usual clearness as to what he designed to convey by the term RESEMBLANCE. This view, however, will be still more obvious by comparing the seventh, ninth, and twenty-third sections of the eighth chapter of his second book, in which he asserts, that the SECONDARY qualities of bodies, as they are usually called, and which he contrasts with the PRIMARY before us, have *no real* existence in their respective bodies, and are nothing more than powers instead of qualities. And hence, while the ideas of the PRIMARY qualities of bodies are real representatives of real qualities, and to this extent RESEMBLE them, the ideas of their SECONDARY qualities are only real representatives of ostensible or imaginary qualities, in regard at least to the subjects to which they appear to belong, and consequently have NO RESEMBLANCE to them whatever.

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* Essay on Hum. Underst. Book ii. ch. viii. § 12.
† Ibid. § 15.
‡ Ibid. § 22.

What, however, Locke thus modestly glanced at, others, with all the confidence of the Greek philosophers, have boldly plunged into; and the consequence has been that they have met with the very same success as the Greek philosophers, and revived the very same errors:—some having been bewildered into a disbelief of the soul, others into a disbelief of the body, and others, again, still more whimsically, into a disbelief of both soul and body at the same time; contending not only that there is no such thing as a world about them, but no such thing as themselves, except at the very moment they start either this or any other idea of equal brilliance.

We have already seen, that the ideas of the mind have no resemblance whatever to the external objects by which they are produced; unless in the case of the primary qualities of bodies, in which, as just observed, the term resemblance may be applied in a figurative sense, the only sense, as I shall show more fully hereafter, in which it was ever employed by Mr. Locke.

This is a fact so clear as to be admitted by almost every school of philosophy. "Between an external object and an idea or thought of the mind," observes Dr. Beattie, "there is not, there cannot possibly be, any resemblance."* So, in continuation, "a grain of sand and the globe of the earth; a burning coal, and a lump of ice; a drop of ink and a sheet of white paper, resemble each other in being extended, solid, figured, coloured, and divisible; but a thought or idea has no extension, solidity, figure, colour, or divisibility: so that no two external objects can be so unlike, as an external object, and (what philosophers call) the idea of it." To the same effect Dr. Potterfield: "How body acts upon mind, or mind upon body, I know not; but this I am very certain of, that nothing can act or be acted upon where it is not; and therefore our mind can never perceive any thing but its own modifications, and the various states of the sensorium to which it is present. So that it is not the external sun and moon which are in the heavens that our mind perceives, but only their image or representation impressed on the sensorium. How the soul of a seeing man sees those images, or how it receives those ideas from such agitations in the sensorium, I know not. But I am sure it can never perceive the external bodies themselves, to which it is not present."

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* On Truth, part ii. ch. ii. p. 165.

Now allowing this fact, it follows of inevitable necessity, that the mind does not of itself perceive an external world; even any thing resembling an external world; and we must take both its existence and the nature of its existence upon the evidence of our external senses. Such an authority may perhaps seem tolerably sufficient to most of my audience; and I trust I shall be able to prove, before we conclude, that the external senses are as honest and as competent witnesses as any court of judicature can reasonably desire. But it has somehow or other happened, as we have already seen, that there have been a few wise and grave men, and of great learning, talents, and moral excellence, in different periods of the world, who have had a strange suspicion of their competency; and have hunted up facts and arguments to prove that their evidence is not worth a straw; that, in some cases, they have shown themselves egregious fools, and in others arrant cheats; that the testimony of one sense often opposes the testimony of another sense; that what appears smooth to the eye appears rough to the touch; that we cannot always distinguish a green from a blue colour; and that we sometimes feel great awe and solemnity beneath a deep and growing sound, which we at first take to be a clap of thunder, but afterwards find to be nothing more than the rumbling of a filthy cart; that we mistake a phantasm, or phantasmagoria, for a figure of flesh and blood; and occasionally see things just as clearly in our dreams as when we are awake, though all the world with which we have then any concern is a world of mere ideas—a world of our own making, and altogether independent of the senses; and, consequently, that it is possible the poet may speak somewhat more literally than he intended, when he tells us

> We are such stuff
> As dreams are made on, and our little life
> Is rounded with a sleep.*

This sort of reasoning, however, has not been confined to modern times; it was, I have already observed, the very arguments of Arcesilas, and the skeptics of the MIDDLE ACADEMY, as it was called; who, in consequence, contended that there is no truth or solidity in any thing: no such thing as certainty or real knowledge; and that all genuine philosophy or wisdom consists in doubting. From a cause somewhat similar, Pyrrho, as I have likewise remarked, seems to have carried his skepticism to a still further extravagance, though a very excellent man and enlightened philosopher in other respects: for he is said to have so far disbelieved the real existence of every thing before him, that precipices were nothing; the points of swords and arrows were nothing; the wheel of a carriage that threatened to go over his neck was nothing. Insomuch that his friends, who were not quite so far gone in philosophy, thought it right to protect him against the effects of his own principles, and either accompanied him themselves or set a keeper over him under the milder name of a disciple. It was in vain that Plato pretended that the mind is loaded with intellectual archetypes, or the incorporeal ideas, of all external objects; Aristotle that it perceives by immaterial phantasms; and Epicurus by real species or effigies thrown forth from the objects themselves: Pyrrho denied the whole of this jargon, and contended that if it could even be proved that the senses uniformly give a true account of things, as far as their respective faculties extend, still we obtain no more real knowledge of matter, of the substance that is said to constitute the external world, than we do of the perceptions that constitute our dreams. If, said he, you affirm that matter consists of particles that are infinitely divisible, you ascribe the attribute of infinity to every particle; and hence make a finite grain of sand consist of millions of infinite atoms; and such is the train of argument of the atomic philosophers. While, on the contrary, if you contend, with the atomists, that matter has its ultimate atoms or primordial particles, beyond which it is not possible to divide and subdivide it, show me some of these particles, and let those senses you appeal to become the judges.

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* Tempest.

Such was the state of things under the Greek philosophers: the existence of an external world and its connexion with the mind was supported, and supported alone, by fine-spun hypotheses, that were perpetually proving their own fallacy; and was denied or doubted of by skeptics who were perpetually proving the absurdity of their own doubts.

Des Cartes, as we have already observed, thought, in his day, it was high time to remove all doubt whatsoever, and to come to a proof upon every thing; and he zealously set to work to this effect. In the ardour of his own mind he had the fullest conviction of a triumph; and like a liberal antagonist he conceded to his adversaries all they could desire. He allowed a doubt upon every thing for the very purpose of removing it by direct proofs. He began, therefore, as we have already seen, by doubting of his own existence: and, as we have also seen, he made sad work of it in the proofs he attempted to offer.

Having satisfied himself, however, upon this point, he next proceeded to prove the existence of the world around him; and, candidly following up the first principle he had laid down for the regulation of his conduct, he was determined to doubt of the evidence of the senses, excepting so far as they could bring proof of their correctness. But what proof had the senses to offer? The very notion of a proof, as I took leave to observe in our last lecture, consists in our obtaining a fact or an idea possessing a closer agreement or connexion with the thing to be proved than the fact or idea that the mind first perceives or is able to lay hold of. But what ideas can more closely agree or be more closely connected with an external world than the ideas produced by the senses, by which alone the mind perceives such world to exist? These are ideas of identity, of self-agreement; and consequently ideas, which, like that of consciousness, it is neither possible to doubt of or to prove. They form, for the most part, a branch of intuitive knowledge, and we are compelled to believe whether we will or not.

I say *for the most part*, for I am now speaking of the common effect of external objects upon the senses, and upon the mental organ. I am ready to admit that, under particular circumstances, the ideas they excite may not be perfectly clear; we may be at too great a distance from the object, or the sense of sight, smell, taste, or touch, may be morbidly or accidentally obtuse; but in all these cases a sound mind is just as conscious of having ideas that are not clear, as it is, under other circumstances, of having distinct ideas. There is no imposition whatever: the mind equally knows that it has certain knowledge in the latter instance, and that it has uncertain knowledge in the former. I mean if it will exert itself to know by the exercise of its own activity; for otherwise it may as well mistake in ideas that originate from itself as in those that originate from the senses. And in the case of its being conscious of an imperfect or indistinct idea, excited by one of the senses, what is the step it pursues? That which it uniformly pursues in every other case of imperfect knowledge: it calls in the aid of an intermediate idea by the exercise of another sense that is more closely connected or more clearly agrees with the idea that raises the question, and the faculty of the judgment determines, as in every other case. And here the knowledge, as I have already hinted at on a former occasion, loses indeed its intuitive character, and assumes, for the most part, the demonstrative.

It was impossible, therefore, for Des Cartes to obtain any proofs whatever; and it being the very preamble of his system that his doubts should remain unless he could remove them by proofs, the only device that seemed to afford him a loop-hole to escape from his dilemma, was an appeal to the veracity of the Creator. God, he asserted, has imprinted on the mind innate ideas of himself and of an external world; and though the senses offer no demonstration of such a world, it is completely furnished to us by these internal ideas: the senses, indeed, may deceive, but God can be no deceiver. And hence what *appears* to exist around us does exist.

The existence of an external world, therefore, in the Cartesian philosophy is doubtful, so far as depends upon the senses; for the testimony they offer is in itself doubtful. And hence it is not upon the evidence of our eyes and our hands, and our taste, smell, and hearing, that we are to believe that there is any body or any thing without us, but on the truth of those innate ideas of a something without us which are supposed to be imprinted on the mind, in connexion with the veracity of the Creator who has imprinted them.

But here another stumbling-block occurred to the progress of our philosophical castle-builder; and that was, the difficulty of determining, in regard to the number and extent of these innate ideas. His friends Gassendi and Hobbes openly denied that there were any such ideas whatever, and put him upon his proofs, by which the whole system would be to be commenced again from its foundation; while Malebranche, one of the most zealous of all the disciples of Des Cartes, at the same time that he contended for the general doctrine of innate ideas, confessed that he had some doubts whether they extended, to the existence of the world without us, or to any thing but a knowledge of God and of our own being.

Although, in his opinion, M. Des Cartes has proved the existence of body by the strongest arguments that reason alone can furnish, and arguments which he seems to suppose unexceptionable; yet he does not admit that they amount to a full demonstration of the existence of matter. In philosophy, says he, we ought to maintain our liberty as long as we can, *and to believe nothing but what evidence compels us to believe.* To be fully convinced of the existence of bodies it is necessary that we have it demonstrated to us, not only that there is a God, and that he is no deceiver, but also that God has assured us that he has actually created such bodies; and this, continues Malebranche, "I do not find proved in the works of M. Des Cartes. The faith obliges us to believe that bodies exist, but as to the evidence of this truth, it certainly is not complete; and it is also certain that we are not invincibly determined to believe that any thing exists but God and our own mind. It is true that we have an EXTREME PROPENSITY to believe that we are surrounded with corporeal beings: so far

I agree with M. Des Cartes: but this propensity, natural as it is, does not force our belief by evidence; it only inclines us to believe by impression. Now we ought not to be determined in our judgments by any thing but light and evidence: if we suffer ourselves to be guided by the sensible impression, we shall be almost always mistaken."*

Thus stood the question when the very learned and excellent Bishop of Cloyne, Dr. George Berkeley, entered upon its investigation. For Locke, as we have already seen, boldly overleaped the Cartesian toll-gate of doubting, and was content to take the knowledge of our own existence upon the authority of intuition, that of a God upon the authority of demonstration, and that of external objects upon the authority of our senses. Berkeley had minutely studied the rival systems of Des Cartes and Locke. With the latter he agreed, that there is no such thing as innate ideas, and with the former, that the creed of a philosopher should be founded upon proof. But Locke had not proved the existence of an external world: he had only sent us to our senses, and had left the questions between ourselves and the evidence they offer; and though this is an evidence which Locke had assented to, Bishop Berkeley conceives it is an evidence that every man ought to examine and sift for himself. Upon this point, then, he deserted Locke for his rival, and commenced a chase for proofs:

He would not, with a peremptory tone,
Assert the nose upon his face his own;

and looked around him for demonstrative evidence whether there be any thing in nature besides the Creator and a created mind. And the well-known result of the chase was that he could discover nothing else: he could discover neither a material world nor matter of any kind; neither corporeal objects nor corporeal senses, with which to feel about for objects; he could not even discover his own head and ears, his own hands, feet, or voice, as substantive existences; and the whole that he could discover was proofs to demonstrate not only that these things have no substantive existence, but that it is impossible they could have any such existence; or in other words, that it is impossible that there can be any such thing as matter under any modification whatever, cognizable by mental faculties.

Let us, however, attend to the limitation that *external* objects can have no *substantive* or *material* existence, for otherwise we shall give a caricature view of this hypothesis, (which it by no means stands in need of,) and ascribe to it doctrines and mischievous results which, if it be candidly examined, will not be found chargeable to it. Dr. Beattie, from not adverting to this limitation, appears, in his humorous description of the Bishop of Cloyne's principles, to have been mistaken upon several points; and it is but justice to the memory of a most excellent and exemplary prelate, as well as enlightened philosopher, to correct the errors into which his equally excellent and enlightened opponent has fallen. When Berkeley asserts that he can prove that there is nothing in existence but a Creator and created mind, and that matter, and, consequently, material objects and material organs have not, and cannot have a being, he does not mean, as Dr. Beattie has represented him to mean, that he himself, or his own mind, is the only created being in the universe;† not that external objects and external qualities do not and cannot exist independent of, and distinct from, created mind. He allows as unequivocally as Dr. Beattie himself the existence of fellow-minds or fellow-beings, possessing appropriate senses, as also the existence of external and real objects, and of external and real qualities, by which such senses are really and definitely influenced: contending alone that none of these objects or qualities are material, or any thing more than effects of the immediate agency of an ever-present Deity, "who," to adopt his own words, "knows and comprehends all things, and exhibits them to our view in such a manner, and according to such rules as he himself has ordained, and are termed by us the laws of nature.—When," says he, "in broad daylight I open my eyes, it is not in my power to choose whether I shall see or no, or to determine what particular objects shall present themselves to my view; and so likewise as to the hearing and other senses, the ideas imprinted on them are not creatures of my will. There is, therefore, some other will or spirit that produces them. The question between the materialist and me is not whether things have a real existence out of the mind of *this* or *that* person, but whether they have an absolute existence, distinct from being perceived by (in) God and exterior to all minds? I assert as well as they, that since we are affected from without, we must allow powers to be without in a being distinct from ourselves. So far we are agreed. But then we differ as to the kind of this powerful being. I will have it to be spirit; they matter, or I know not what third nature."*

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* Recherche de la Verite, tom. iii. pp. 30. 39.
† Beattie on Truth, 8vo. p. 159.

According to Dr. Beattie, Berkeley taught "that external objects (that is, the things which we take for external objects) are nothing but ideas in our minds; and that independent of us and our faculties, the earth, the sun, and the starry heavens, have no existence at all; that a lighted candle has not one of those qualities which it appears to have; that it is not white, nor luminous, nor round, nor divisible, nor extended; but that for any thing we know, or can ever know, to the contrary, it may be an Egyptian pyramid, the King of Prussia, a mad dog, the island of Madagascar, Saturn's ring, one of the Pleiades, or nothing at all."

Now all this shows a fruitful fund of pleasantry, but in the present case it is pleasantry somewhat misapplied. It would indeed be a woful state of things if such were the confusion or anomaly of our ideas, that we could never distinguish one object from another, and were for ever mistaking the King of Prussia for an Egyptian pyramid, a lighted candle for a mad dog, and the island of Madagascar for the Pleiades or Saturn's ring. But it would be a state of things no more chargeable to Dr. Berkeley's than to Dr. Beattie's view of nature; since the former supposes as perfect a reality in external objects, that they have as perfect an independence of the mind that perceives them, the possession of as permanent and definite qualities, and as regular a catenation of causes and effects, as the latter. Or, in other words, it supposes that all things exist as they appear to exist, and must necessarily produce such effects as we find them produce, but that they do not exist corporeally; that they have no substrate, and can have no substrate of matter, nor any other being than that given them by the immediate agency of the Deity; or, in still fewer words, that all things exist and are only seen to exist in God: a representation of nature, which, however erroneous, is by no means necessarily connected with those mischievous and fatal consequences which Dr. Beattie ascribed to it, and which, if fairly founded, must have been sufficient not only to have deterred Bishop Berkeley from starting it at first, but those very excellent prelates and acute reasoners, Bishop Sherlock and Bishop Smallwood, from becoming converts to it afterwards.

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* Princip. of Human Knowledge.

The hypothesis, however, after taking away all undue colouring, and regarding it as merely assuming the non-existence of matter and a material world, is still abundantly absurd in a philosophical point of view. Yet so fully had Berkeley persuaded himself of its truth, that he had the firmest conviction that if the world be, as it is said to be, composed of men, women and children, of a corporeal and material make, with ground beneath our feet, and a sky over our heads, every body must in his heart believe as he believed, namely, that there are no such women nor children, no such ground, sky, or any thing else but mind and mental perception. Nevertheless, whichsoever creed be true, he contended that it could make no difference in the regulation of our moral conduct; which he endeavours to prove by the following notable strain of argument: "That nothing gives us interest in the material world except the feelings, pleasant or painful, which accompany our perceptions; that these perceptions are the same whether we believe the material world to exist or not to exist; consequently, that our pleasant or painful feelings are also the same; and therefore that our conduct, which depends on our feelings and perceptions, must be the same whether we believe or disbelieve the existence of matter."

The more we reflect on the native vigour and acuteness of Bishop Berkeley's mind, as well as upon his extensive information and learning, the more we must feel astonished that he could for one moment be serious in the profession of so wild and chimerical a creed. And to those who are not acquainted with the subject it may perhaps appear impossible for the utmost stretch of human ingenuity to push such a revery any farther.

To the possession of such ingenuity, however, the celebrated author of the "Treatise on Human Nature," is fairly and fully entitled. This notable performance, though published anonymously, is well known to be the production of Mr. Hume; and though, in the Essays to which his name appears, he makes some scruple of acknowledging it, and hints at its containing a few points which he subsequently thought erroneous, he maintains, in his avowed volumes, the same principles and the consequences of those principles so generally, that it is difficult to understand what errors he would wish the world to suppose he had ever retracted.

In mounting into the sublime regions of metaphysical absurdity, Bishop Berkeley furnished him with the ladder; but as I have already hinted, Hume ascended it higher, and, consequently, in his own opinion, had a more correct and extensive view of the airy scene before him.

If, said he, there be nothing in nature but mind and the perceptions of mind,—perceptions diversified, indeed, by being sometimes stronger and sometimes weaker, and which may hence be properly distinguished by the names of impressions and ideas,—how do we know that we possess a mind any more than that we possess a body, which no reasonable man or philosopher can possibly think of contending for? How do we know that there is any thing more than impressions and ideas? This is the utmost we can know; and even this we cannot know to a certainty: for nobody but fools will pretend certainly to know or to believe any thing. These ideas and impressions follow each other, and are therefore conjoined, but we have no proof that there is any necessary connexion between them. They are "a bundle of perceptions that succeed each other with inconceivable rapidity, and are in a perpetual flux;"* and hence I myself of to-day am no more the I myself of yesterday or to-morrow, than I am Nebuchadnezzar or Cleopatra.

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* Treat. of Human Nat. vol. i. p. 438, &c.

Now all this nonsense in Bishop Berkeley, even had His Lordship gone so far, which, however, he did not do, we could laugh at; for his mind was of too excellent a cast to mean mischief. But it is impossible to make the same allowance to Mr. Hume, since the doctrines he attempts to build upon this nonsense effectually prevent us from doing so.

If the mind of every man become every moment a different being, all punishment for crime must be absurd; for you can never hit the culprit, who is every moment slipping through your fingers, and may as well hang the sheriff as the thief. No philosopher, it seems, can even dream of believing in an external world, and yet (putting by the trash of innate ideas) what other arguments have we, continues the same school, if school it may be called, for the existence and attributes of a Supreme Being. You may talk of power, but it is a word without a meaning: we can form no idea of power, nor of any being endued with any power, much less of a being endued with infinite power. And we can never have reason to believe that any object or quality of an object exists of which we cannot form an idea. It is, indeed, unreasonable to believe God to be infinitely wise and good while there is any evil or disorder in the universe; nor have we any sound reason to believe that the world, whatever it may be, proceeds from him, or from any cause whatever. We can never fairly denominate any thing a cause till we have repeatedly seen it produce like effects; but the universe is an effect quite singular and unparalleled; and hence it is impossible for us to know any thing of its cause; it is impossible for us to know that there is any universe whatever; any creature or any Creator; or any thing in existence but impressions and ideas.*

It is not my intention to enter into these arguments, nor is it necessary. For though there had been ten times more force or more folly in them than there is, we have already traced the Babel-building to its foundation, and know that it rests upon emptiness.

Scotland has the disgrace of having given birth to this hydra of absurdity and malignity: she has also the honour of having produced the Hercules by whom it has been strangled. She has, indeed, amply atoned: for she has produced a Hercules in almost every one of her universities. True to the high charge reposed in them, the public guardians of her morals have started forth from Edinburgh, Glasgow, and Aberdeen, armed in celestial panoply, and equally masters of their weapons. Neither argument nor raillery have been spared on the occasion; and instead of invidiously inquiring whether Reid, Beattie, or Stewart be chiefly entitled to the honours of the victory, let us vote them our thanks in the aggregate. The only regret (and it is incident to human affairs that in almost every victory there should be a regret) is that in pulling down one hypothesis they should have thought it requisite to build up another, and to give a proof of their own weakness in the midst of their own triumph. But this is a subject which must be reserved for our next lecture. I cannot, however, consent to quit our present connexion with Mr. Hume without adverting to Dr. Beattie's very witty, and I may say, for the most part, logical pleasantry upon the leading principle of Mr. Hume's hypothesis, that our impressions and ideas of things only differ in degrees of strength; the idea being an exact copy of the impression, but only accompanied with a weaker perception. Upon this proposition Dr. Beattie remarks as follows:* " When I sit by the fire, I have an impression of heat, and I can form an idea of heat when I am shivering with cold; in the one case I have a stronger preception of heat, in the other a weaker. Is there any warmth in this idea of heat? There must, according to this doctrine; only the warmth of the idea is not quite so strong as that of the impression. For this author repeats it again and again, that ' an idea is by its nature weaker and fainter than an impression, but is in every other respect' (not only similar but) ' the same.'† Nay, he goes further, and says, that " whatever is true of the one must be acknowledged concerning the other;‡ and he is so confident of the truth of this maxim, that he makes it one of the pillars of his philosophy. To those who may be inclined to admit this maxim on his authority, I would propose a few plain questions. Do you feel any, even the least, warmth, in the idea of a bonfire, a burning mountain, or the general conflagration? Do you feel more real cold in Virgil's Scythian winter, than in Milton's description of the flames of hell? Do you acknowledge that to be true of the idea of eating, which is certainly true of the impression of it, that it alleviates hunger, fills the belly, and contributes to the support of human life? If you answer these questions in the negative, you deny one of the fundamental principles of this philosophy. We have, it is true, a livelier perception of a friend when we see him, than when we think of him in his absence. But this is not all: every person of a sound mind knows, that in the one case we believe, and are certain, that the object exists, and is present with us; in the other we believe, and are certain, that the object is not present: which, however, they must deny, who maintain, that an idea differs from an impression only in being weaker, and in no other respect whatsoever.

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* Mr. Hume seems to have been only a speculative advocate of his own doctrines: the Bishop of Cloyne, like the Greek skeptics to whom we have formerly adverted, were real believers. And it is not a little singular that the fundamental atheism on which the doctrines of Boodhism are founded, as professed throughout the Burman empire, has given rise, even in the present day, to a sect of philosophical skeptics of the very same kind; of which Mr. Judson, the intelligent American missionary, to whom I have already alluded, (Ser. III. Lect. III.) gives us, in his Journal, the following notable example: "May 20, 1821. Encountered another new character, one Moung Long, from the neighbourhood of Shway-doung, a disciple of the great Tong-dwan teacher, the acknowledged head of all the semi-atheists in the country. Like the rest of the sect, Moung Long is, in reality, a complete skeptic, scarcely believing his own existence. They say he is always quarrelling with his wife on some metaphysical point. For instance, if she says, "The rice is ready," he will reply, "Rice! What is rice? Is it matter or spirit? Is it an idea, or is it non-entity?" Perhaps she will say, "It is matter!" and he will reply, "Well, wife, and what is matter? Are you sure there is any such thing in existence, or are you merely subject to a delusion of the senses?"—Account of the American Baptist Mission to the Burman Empire, &c. by A. H. Judson, p. 304, 8vo. Lond. 1823.

" That every idea should be a copy and resemblance of the impression whence it is derived; that, for example, the idea of red should be a red idea; the idea of a roaring lion a roaring idea; the idea of an ass, a hairy, long-eared, sluggish idea, patient of labour, and much addicted to thistles; that the idea of extension should be extended, and that of solidity, solid; —that a thought of the mind should be endued with all, or any, of the qualities of matter,—is, in my judgment, inconceivable and impossible. Yet our author takes it for granted; and it is another of his fundamental maxims. Such is the credulity of skepticism!"

It is a singular coincidence, that while the substantive existence of an external world was thus hotly attacked by metaphysics, the science of

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[*] Beattie on Truth, part ii. ch. ii.

[†] Treatise of Human Nature, vol. i. p. 131.

[‡] Ibid. p. 41.

physics should have proved just as adverse to it: thus reviving, as we have already seen, the very same double assault to which it had been exposed at Athens, shortly after the establishment of the Academy. This latter controversy commenced and hinged upon what are the real qualities of matter. Heat, cold, colours, smell, taste, and sounds, had been pretty generally banished from the list about the middle of the seventeenth century. Locke contended, after Sir Isaac Newton, for solidity, extension, mobility, and figure: but it was soon found that there is a great difficulty in granting it solidity; that the particles of bodies never come into actual contact, or influence each other by the means of objective pressure; that however apparently solid the mass to which they belong, such mass may be reduced to a smaller bulk by cold, as it may be increased in bulk by heat; that we can hence form no conception of perfect solidity, and every fact in nature appears to disprove its existence. The minutest corpuscle we can pick out is capable of a minuter division, and the parts into which it divides possessing the common nature of the corpuscle which has produced them, must necessarily be capable of a still farther division; and as such divisions can have no assignable limit, matter must necessarily and essentially be divisible to infinity. For these and similar reasons M. Boscovich contended that there is no such thing as solidity in matter; nor any thing more than simple, unextended, indivisible points, possessing the powers of attraction and repulsion, yet producing extension by their combination.*

Upon the self-contradiction of this hypothesis I have found it necessary to comment on a former occasion;† and shall now, therefore, only further observe that it just as completely sweeps the whole of matter away with a physical broom, as the systems of Berkeley and Hume do with a metaphysical; for, by leaving us nothing but inextended points, possessing mere powers without a substrate, it leaves nothing at all,—a world indeed, but a world " without form, and void;" with darkness, not only upon the face of the deep, but there and every where else.

" That nothing," says Dr. Reid, " can act immediately where it is not, I think must be admitted; for I think, with Sir Isaac Newton, that power without substance is inconceivable." Lord Kames, however, in his Elements of Criticism, though a strong advocate for the common-sense system, expresses his doubts of the doctrine contained in this passage.

To complete the folly of the age, and fix the laugh of the simple against the wise, while Berkeley, Hume, and Boscovich were thus in their different ways, dissipating the world of matter, in favour of the world of mind, another set of philosophers started up,—

> ——— impios
> Titanas, immanemque turmam,‡
>
> An impious, earth-born, fierce, Titanic race,—

and put to flight the world of mind in favour of the world of matter. Hobbes, who was a contemporary, and friend of Des Cartes, courageously led the van, and did ample justice, and somewhat more than ample justice, to the senses, by contending that we have no other knowledge than what they supply us with, and what they themselves derive from the world before them; that the mind is nothing more than the general result of their action; and that with them it begins, and with them it ceases.

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* Theoria Philosophiæ Naturalis, Vien. 1758.

† Series I. Lect. III. See also Dr. Wollaston's paper " On the finite extent of the Atmosphere," Phil. Trans. 1822. p. 89.

‡ Hor. lib. iii. 4.

To Hobbes succeeded Spinosa, who was born in the very same year with Locke, and who carried forward the crusade of matter against mind, to so illimitable a career, that he made the world, the human senses, the human soul, and the Deity himself, matter and nothing else: all one common material being; no part of which can or ever could exist otherwise than as it is, and consequently every part of which is equally the creature and the Creator.

In the midst of these indiscriminate assaults, appeared Hartley; whose learning, benevolence, and piety, entitle his memory to be held in veneration by every good man. He strenuously contended for the existence of mind and matter as distinct principles; and conceived it was in his power to settle the general controversy, by showing what Locke had failed to do, or rather what he had too much modesty to attempt; the direct means by which the external senses, and consequently the external world, operates upon the mind. And hence arose the well known and at one time highly popular hypothesis of the association of ideas. It was conceived by Dr. Hartley that the nervous fibrils, which form the medium of communication between the external senses and the brain or sensory, are solid and elastic capillaments; that on every impression of objects upon the senses the nervous chord, immediately connected with the sense, vibrates through its whole length and communicates the vibration to the substance of the brain, and particularly to its central region, which is the seat of sensation, leaving upon every communication a mark or vestige of itself; which produces a sensation, and excites its correspondent perception or idea. The more frequently these vibrations are renewed, or the more vigorously they are impressed, the stronger will be the vestiges or ideas they induce; and as, in every instance, they occasion vibratiuncles, or miniature vibrations, through the substance of the brain itself, a foundation is hereby laid for a series of slighter vestiges, sensations, and ideas after the primary vibrations have ceased to act. And hence originate the faculties of memory and imagination. And as any order of vibrations, by being associated together a certain number of times, obtain a habit of mutual influence, any single sensation or single idea belonging to such order acquires a power of calling the whole train into action, either synchronously or successively, whenever called into action itself.

Now according to this system the brain of man is a direct sensitive violin, consisting of musical strings, whose tones go off in thirds, fifths, and eighths, as regularly as in a common fiddle, through the whole extent of its diapason; and the orator who understands his art, may be said, without a figure, to play skilfully upon the brains of his auditors. The hypothesis, however, is ingenious and elegant, and has furnished us with a variety of detached hints of great value; but it labours under the following fatal objections. First, the nervous fibres have little or no elasticity belonging to them, less so perhaps than any other animal fibres whatever; and next, while it supposes a soul distinct from the brain, it leaves it no office to perform: for the medullary vibrations are not merely causes of sensations, ideas, and associations, but in fact the sources of reason, belief, imagination, mental passion, and all other intellectual operations whatever.

Admitting, therefore, the full extent of this hypothesis, still it gives us no information about the nature of the mind and its proper functions; and leaves us just as ignorant as ever, of the power by which it perceives the qualities of external objects. The difficulty was felt by many of the advocates for the associate system, especially by Priestley and Darwin; and it was no sooner felt than it was courageously attacked, and in their opinion completely overcome. Nothing was clearer to them than that Dr. Hartley had overloaded his system with machinery: that no such thing as a mind was wanting distinct from the brain or sensory itself: that ideas, to adopt the language of Darwin, are the actual contractions, motions, or configurations of the fibres which constitute the immediate organ of sense, and consequently material things;* or, to adopt the language of Priestley, that ideas are just as divisible as the archetypes or external objects that produce them; and, consequently, like other parts of the material frame, may be dissected, dried, pickled, and packed up, like herrings for home-consumption or exportation, according as the foreign or domestic market may have the largest demand for them. And consequently, also, that the brain or sensory, or the train of material ideas that issue from it, is the soul itself; not a fine-spun flimsy immaterial soul or principle of thought, like that of Berkeley or even of Hume, existing, unconnectedly in the vast solitude of universal space, but a solid, substantial, alderman-like soul, a real spirit of animation, fond of good cheer and good company; that enters into all the pursuits of the body while alive, and partakes of one common fate in its dissolution.

If there be too much crassitude in this modification of materialism, as has generally been supposed, even by materialists themselves, there is at least something tangible in it: something that we can grasp and cope with, and fix and understand; which is more, I fear, than can be said of those subtler and more complicated modifications of the same substrate, which have somewhat more lately been brought forward in France to supply its place, and which represents the human fabric as a duad, or even a triad of unities, instead of a mixed or simple unity; as a combination† of a corruptible life within a corruptible life two or three deep, each possessing its own separate faculties or manifestations, but covered with a common outside.

This remark more especially applies to the philosophers of the French school; and particularly to the system of Dumas,‡ as modified by Bichat; under which more finished form man is declared to consist of a pair of lives, each distinct and co-existent, under the names of an organic and an animal life; with two distinct assortments of sensibilities, an unconscious and a conscious. Each of these lives is limited to a separate set of organs, runs its race in parallel steps with the other; commencing coetaneously and perishing at the same moment.§ This work appeared at the close of the past century; was read and admired by most physiologists; credited by many, and became the popular production of the day. Within ten or twelve years, however, it ran its course, and was as generally either rejected or forgotten even in France; and M. Richerand first, and M. Magendie since, have thought themselves called upon to modify Bichat, in order to render him more palatable, as Bichat had already modified Dumas. Under the last series of remodelling, which is that of M. Magendie, we have certainly an improvement, though the machinery is quite as complex. Instead of two distinct lives M. Magendie presents us with two distinct sets or systems of action or relation, each of which has its separate and peculiar functions, a system of nutritive action or relation, and a system of vital. To which is added, by way of appendix, another system, comprising the functions of generation.* Here, however, the brain is not only the seat, but the organized substance of the mental powers : so that, we are expressly told, a man must be as he is made in his brain, and that education and even logic itself is of no use to him. ‘ There are,’ says M. Magendie, ‘justly celebrated persons who have thought differently ; but they have hereby fallen into grave errors.’ A deity however is allowed to exist, because, adds the writer, it is comfortable to think that he exists, and on this account the physiologists cannot doubt of his being. ‘ L’intelligence de l’homme,’ says he, ‘ se compose de phénoménes tellement différens de tout ce que présente d’ailleurs la nature, qu’on les rapporte à un être particuliere qu’on regarde comme une emanation de la Divinité. Il est trop *consolant de croire à cet être*, pour que le physiologiste métte en doute son existence ; mais la sévérité de language ou de logique que comporte maintenant la physiologie exige que l’on traite de l’intelligence humaine comme si elle était le résultat de l’action d’un organe. En *s’écartant* de cette marche, des hommes justement célèbres sont tombés dans des *graves erreurs ;* en la suivant, on a, d’ailleurs, le grand avantage de conserver la même méthode d’étude, et de rendre trés faciles des choses qui sont envisagées généralement comme presqu’ au-dessus de l’esprit humain.’—‘ Il existe une science dont le but est d’apprendre â raisonner justement : c’est *la logique :* mais le jugement erroné ou l’esprit faux (for judgment, genius, and imagination, and therefore false reasoning, all depend on organization,) tiennent à l’organization. Il est impossible de se changer à cet egard ; nous restons, tels que *la nature* nous à faits.”†

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* Zoon. vol. i. p. 11, edit. 3.

† Stud. of Med. vol. iv. p. 41—45. edit. 2.

‡ Principes de Physiologie, tom. iv. 8vo. Par. 1800—3.

§ Recherches sur la vie et la Mort, &c.

Dr. Spurzheim has generally been considered, from the concurrent tenor of his doctrines, as belonging to the class of materialists ; but this is to mistake his own positive assertion upon the subject, or to conclude in opposition to it. He speaks, indeed, upon this topic with singular hesitation and reserve, more so, perhaps, than upon any other point whatever ; but as far as he chooses to express himself on so abstruse a subject, he regards the soul as a distinct being from the body, and at least intimates that i *may be* nearer akin to the Deity. Man is with him also possessed of two lives, an AUTOMATIC and an ANIMAL : the first produced by organization alone, and destitute of consciousness ; the second possessed of consciousness dependent on the soul, and merely manifesting itself by organization. ‘ We do not,’ says he, ‘ attempt to explain how the body and soul are joined together and exercise a mutual influence. We do not examine what the soul can do without the body. Souls, so far as we know, may be united to bodies at the moment of conception or afterwards ; they may be different in all individuals, or of the same kind in every one ; they may be emanations from God, or something essentially different.’‡ The mind of this celebrated craniologist seems to be wonderfully skeptical and bewildered upon the subject, and studiously avoids the important question of the capacity of the soul for an independent and future existence ; but with the above declaration, he cannot well be arranged in the class of materialists.

The hypothesis which has lately been started by Mr. Lawrence§ is altogether of a different kind, and though undoubtedly much simpler than any of the preceding, does not seem to be built on a more stable foundation. According to his view of the subject, organized differs from inorganized matter merely by the addition of certain PROPERTIES which are called vital, as sensibility and irritability. Masses of matter endowed with these new PROPERTIES become organs and systems of organs, constitute an animal frame, and execute distinct sets of PURPOSES or FUNCTIONS; for functions and purposes carried into execution are here synonymous. 'Life is the assemblage of ALL the functions (or purposes), and the general result of their exercise.'*

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* Precis Elementaire de Physiologie, tom. ii. 8vo. Paris, 1816, 1817.

† Precis Elementaire, &c. ut supra, passim.

‡ Physiognomical System, &c. p. 253. 8vo. Lond. 1815.

§ Introduction to Comparative Anatomy and Physiology, &c. 8vo. 1816.

Life, therefore, upon this hypothesis, instead of being a two-fold or three-fold reality, running in a combined stream, or in parallel lines, has no reality whatever. It has no ESSE or independent existence. It is a mere assemblage of PURPOSES, and accidental or temporary PROPERTIES: a series of phænomena,† as Mr. Lawrence has himself correctly expressed it;—a name without a thing. "We know not," says he, "the nature of the link that unites these phænomena, though we are sensible that a connexion must exist; and this conviction is sufficient to induce us to give it a NAME, which the VULGAR regard as the sign of a particular principle; though in fact that name can only indicate the ASSEMBLAGE OF THE PHÆNOMENA which have occasioned its formation."‡

The human frame is, hence, a barrel-organ, possessing a systematic arrangement of parts, played upon by peculiar powers, and executing particular pieces or purposes; and life is the music produced by the general assemblage or result of the harmonious action. So long as either the vital or the mechanical instrument is duly wound up by a regular supply of food or of the wince, so long the music will continue; but both are worn out by their own action; and when the machine will no longer work, the life has the same close as the music; and in the language of Cornelius Gallus, as quoted and appropriated by Leo X.,

> —— redit in nihilum, quod fuit ante nihil.

There is, however, nothing new either in this hypothesis or in the present explanation of it. It was first started in the days of Aristotle by Aristoxenus, a pupil of his, who was admirably skilled in music, and by profession a physician. It was propounded to the world under the name of the system of HARMONY, either from the author's fondness for music, or from his comparing the human frame to a musical instrument, and his regarding life as the result of all its parts acting in accordance, and producing a general and harmonious effect.§

We have already had occasion to notice this hypothesis in a former lecture, and the triumphant objections with which it was met by the Stoics as well as by the Epicureans;‖ as also that it has at times been revived since, and especially by M. Lusac, who extended it to even a wider range: while the same objections remain unanswered to the present hour, and seem to be altogether unanswerable.

There is, moreover, the same looseness in the term PHÆNOMENA, employed by Mr. Lawrence, and the French writers just adverted to, as we have remarked in many of the opposers of Mr. Locke, who seem to be afraid of fettering themselves with definite terms or definite ideas. This looseness may be convenient in many cases, but it always betrays weakness or imprecision. In the mouth of the Platonists and Peripatetics of ancient Greece, we distinctly know that the term phænomena denoted the archetypes of the one, or the phantasms of the other. We understand it with equal clearness as made use of, though in very different senses, by Leibnitz in reference to his system of PRE-ESTABLISHED HARMONY, and by Professor Robson, in reference to that of Boscovich. But when M. Magendie, or Mr. Lawrence, tells us that "human intelligence," which is the phrase of the former, in the passage just quoted, or "life," which is that of the latter, is a COMPOSITION OR ASSEMBLAGE of PHÆNOMENA,—a "RESULT OF THE ACTION of an organ,"—we have no distinct notion whatever put before us. The "purposes," or "properties," or "functions," or whatever it is they intend under the name of PHÆNOMENA, certainly do not seem to be strictly material in themselves, though we are told they are, in some way or other, the product of a material organ: but whether they be the phantasms of the Greek schools, the visions of Malebranche or Berkeley, the mathematical points of Boscovich, the APPARITIONS OR APPEARANCES of the Common-Sense hypothesis,—whether they be a name or a thing, any thing or nothing, the writers themselves having given us no clue to determine, and perhaps have hardly determined for themselves.

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* Introduction to Comparative Anatomy and Physiology, &c. p. 120.

† Ibid. p. 122. ‡ Ibid.

§ Stud. of Med. ut supra.

‖ Series I. Lect. IX. on the Principle of Life.

We have thus travelled over a wide extent of ground, but have not yet quite reached our journey's end. It still remains to us to examine the popular hypothesis of the present day, put forth from the north, under the captivating title of the System of Common Sense; produced undoubtedly from the best motives, and offered as an universal and infallible specific for all the wounds and weaknesses we may have incurred in our encounters with the preceding combatants.

The consideration of this shall form the subject of our ensuing lecture; and I shall afterwards, by your permission, follow up the whole by submitting a few general observations on the entire subject, and endeavour to collect for your use, from the wide and tangled wilderness in which we have been beating, the few flowers and the little fruit that may be honestly worth the trouble of preservation.

LECTURE VI.

ON THE HYPOTHESIS OF COMMON SENSE.

IT must be obvious, I think, to every one who has attentively watched the origin and progress of those extraordinary and chimerical opinions through which we have lately been wading, and which have been dressed up by philosophers of the rarest endowments and deepest learning, into a show of systems and theories, that the grand cause of their absurdities is attributable to the imperfect knowledge we possess respecting the nature and qualities of matter, and the nature and qualities of those perceptions which material objects produce in the mind, through the medium of the external senses.

These perceptions, however accounted for, and whatever they have been supposed to consist in, have in most ancient, and in all modern schools been equally denominated ideas; and hence ideas have sometimes implied modifications, so to speak, of pure intelligence, which was the opinion of Plato and of Berkeley; of immaterial apparitions or phantasms, which was that of Aristotle, and in a certain sense may perhaps be said to have been that of Hume; of real species or material images, which was that of Epicurus, of Sir Kenelm Digby,* and many other schoolmen of the middle of the seventeenth century; of mere notional resemblances, which was that of Des Cartes; and of whatever it was the ultimate intention of any of these scholastic terms to signify, whether phantasm, notion, or species; whatever is the object of the understanding when a man thinks, or the mind can be employed about when thinking, which was that of Locke, and is the fair import of the word in popular speech.

It is possible, moreover, that this indiscriminate use of the same term to express different apprehensions, and particularly in modern times, has contributed to many of the errors which are peculiarly chargeable to the metaphysical writers of modern times. But this opinion has been carried much farther by Dr. Reid, who has persuaded himself that the word *idea* has been the rock on which all the metaphysical systematizers, from the time of Aristotle to his own era, have shipwrecked themselves; and hence, having determined to oppose the absurdities of his own countryman Mr. Hume, by the introduction of a new hypothesis, he thought the better way would be to clear the ground on every side, by an equal excommunication of this mischievous term, and of every system into which it had ever found an entrance; whence all the authors of such systems, whatever may have been their views or principles in other respects, he has lumped together by the common name of *Idealists*.

The motive of Dr. Reid was pure and praiseworthy; he entered the arena with great and splendid talents; and soon found himself powerfully abetted by his friends Dr. Adam Smith, Dr. Beattie, Lord Kames, Dr. Campbell, and Mr. Dugald Steward: but it must be obvious to every one, that in the execution of his motive he has carried his resentment to a strange and somewhat ludicrous extreme. *Idea* is a word sufficiently harmless in itself, and even his own friends have not chosen to follow him in his Quixotic warfare against it; and have consequently continued to use it, in spite of his outlawry and proscription: while to arrange under the same banner every one who has employed this term, and to impute the same dangerous tendency to every hypothesis in which it is to be met with, is to make the wearing of a blue or a chocolate coat a sure sign of treason, and to assert that every man who is found thus habited deserves hanging.

Mr. Locke distinctly tells us, that he uses the term idea in its popular sense, and only in its popular sense. But he uses it, and that is enough: the mischief is in the word itself. It has, however, been attempted to be proved that he has not always known the sense in which he did use it; and that he has sometimes employed it in a popular and sometimes in a scholastic import, as denoting that certain ideas are not mere notional perceptions, but material images or copies of the objects which they indicate, by which means he has given a strong handle to such materialists, or favourers, of materialism, as Hartley, Priestley, and Darwin ; while, by his striking away from bodies all their secondary qualities, as taste, smell, sound, and colour, he has given a similar handle to such immaterialists as Berkeley and Hume.

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* He was warmly opposed by Alexander Ross, of Hudibrastic memory, who was a staunch Aristotelian, and, consequently, denied the materiality of ideas. See Ross's argument in Professor Stewart's Essays, vol. i. p. 556. 4to.

Now it is not often that a theory is accused of leaning north and south at the same time ; and whenever it can be so accused, the charge is perhaps the highest compliment that can be paid to it, as proving its uprightness and freedom from bias. But it was absolutely necessary for the success of the new hypothesis that the Essay on Human Understanding should be demonstrated to be radically erroneous, and particularly to have some connexion in the way of causation with what may be called the physical speculations of the day, whether of materialism or of immaterialism : since so long as this remained firm, so long as the system maintained its ground, the immortal edifice proposed to be erected—*monumentum ære perennius*—could find no place for a foundation ; and on this account, and so far as I can learn, on this account alone, the name of Locke has been placed among " the most celebrated promoters of modern skepticism ;"* though it is admitted, that nothing was farther from his intention.

It is hence requisite, before we enter upon a survey of this new hypothesis, to inquire how far the objections which were offered against Mr. Locke's theory are founded in fact. I have already mentioned two of the more prominent, and I shall have occasion to mention two others immediately.

We are told, in the first place, that Mr. Locke has not used the term idea in all instances in one and the same signification ; and that while it sometimes imports something separate from body, it sometimes imports a modification of body itself.

But this is egregiously to mistake his meaning, and to charge him with a confusion of conception which only belongs to the person who can thus interpret him. Des Cartes, after most of the Greek philosophers, had asserted, that our ideas are in some way or other exact images of the objects presented to the senses : Mr. Locke, in opposition to this assertion, contended that so far from being exact images they have not the smallest resemblance to them in any respect, with the exception of those ideas that represent the real or primary qualities of bodies, or such as belong to bodies intrinsically : and which, in his own day, were supposed to consist of figure, extension, solidity, motion, or rest, and number. These qualities being REAL in the bodies in which they appear, the ideas which REALLY represent them are, in his opinion, entitled to be called RESEMBLANCES of them ; while the ideas of the secondary qualities of bodies, or those which are not real, but merely ostensible, or which, in other words, do not intrinsically belong to the bodies in which they appear, as colour, sound, taste, and smell, are not entitled to be called resemblances of them. Now what does such observation upon these two sets of qualities amount to ? Plainly and unequivocally to this, and nothing more : that as the first set of ideas are real representatives of real qualities, and the latter real representatives of ostensible qualities, there is in the former case a resemblance of reality, though there is no other resemblance, and in the latter case, no resemblance of reality, and consequently no resemblance whatever. The resemblance is in respect to the reality of the qualities perceived: it is simply a resemblance of reality: here it begins and here it ends. But the adverse commentators before us contend that it neither begins nor ends here; and that the word resemblance must necessarily import an actual and material resemblance,—a corporeal copy or image; and that consequently the class of ideas referred to must necessarily be material and corporeal things. So that it is not allowable to any man to say, that truth resembles a rock, unless he means, and is prepared to prove, that truth is a hard, stony mass of matter, jutting into the sea, and fatal to ships that dash against it.

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* Beattie on Truth : compare part ii. chap. ii. § 1 2. with the opening of part ii. ch. ii. § 2

But many of Mr. Locke's own followers are said to have understood him in this sense. Not, however, in regard to this distinction: though I am ready to admit that many of those who have pretended to be his followers have misunderstood him upon the subject of ideas generally, and have affirmed, in direct opposition to his own words that, in the Essay on Human Understanding, all our ideas of sensation are supposed to be sensible representations or pictures of the objects apprehended by the senses. This observation particularly applies to Locke's French commentators and followers, Condillac, Turgot, Helvetius, Diderot, D'Alembert, Condorcet, Destutt-Tracy, and Degerando; concerning whom Professor Stewart has made the following just remark; that while "these ingenious men have laid hold eagerly of this common principle of reasoning, and have vied with each other in extolling Locke for the sagacity which he has displayed in unfolding it, hardly two of them can be named who have understood it precisely in the sense annexed to it by the author. What is still more remarkable, the praise of Locke has been loudest from those who seem to have taken the least pains to ascertain the import of his conclusions."*

The term OBJECT Mr. Locke has occasionally used in an equally figurative sense. Thus book ii. chap. i. sect. 24.: "In time," says he, "the mind comes to reflect on *its own operations* about the ideas got by sensation; and thereby stores itself with *a new set of ideas*, which I call *ideas of reflection*. These are the *impressions* that are made on our senses by OUTWARD OBJECTS that are extrinsical to the mind, and *its own operations* proceeding from powers intrinsical and proper in itself; which when reflected on by itself, becoming also OBJECTS of its contemplation, are, as I have said, the originals of all knowledge."

No words can more clearly prove that Locke regarded ideas of sensation as *impressions* made by external objects, and not as objects themselves; and ideas of reflection as *operations* of the mind, and no more objects, literally so considered, than in the preceding case. And hence, when, towards the close of the above passage, he applies the term objects to these operations, he can only in fairness be supposed to do it in a figurative sense: in which sense, indeed, he applies the same term to ideas of all kinds in another place, where he explains an idea to be "whatsoever is the OBJECT of the understanding when a man thinks." And yet he has been accused, by the School of Common Sense, of using the term literally; and it is "to Doctor Reid," says Mr. Stewart, "that we owe the important remark that all these notions (images, phantasms, &c.) are wholly hypothetical;"† and that we have no ground for supposing that in any operation of the mind there exists in it an *object distinct* from the mind itself.

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* Essays, vol. i. p. 102. † Elem. ch. iii. § ii. Fearne's Essay, p. 23.

With respect to the division of the qualities of bodies just adverted to, though derived from the views of Sir Isaac Newton, I am ready to admit that it is loose, and in some respects perhaps erroneous. Nor is this to be wondered at; for I have already had frequent occasions to observe that it is a subject upon which we are totally ignorant; and that we are rather obliged to suppose, than are capable of proving the existence of even the least controverted primary qualities of bodies, as extension, solidity, and figure, in order to avoid the falling into the absurdity of disbelieving a material substrate. But the supporters of the new hypothesis have no reason to triumph upon this point, since it is a general doctrine of their creed that all the qualities of matter are equally primary or real; in the interpretation of which, however, the sentiments of Mr. Stewart are wider from those of Dr. Reid than Dr. Reid's are from Mr. Locke's.

Nor are they altogether clear from the very same charge here advanced against Mr. Locke: “ Professor Stewart in his Elements says, ‘ Dr. Reid has justly distinguished the quality of colour from what he calls the *appearance* of colour, which last can only exist in a mind.” And Dr. Reid himself says, ‘ The name of colour belongs indeed to the cause only, and not to the effect.’ ” Here, then, we have it unequivocally from Dr. Reid, that colour is a quality in an external body,—and the sensation occasioned by it in the mind is *only* the *appearance* of that external quality!!—Would any one suppose that such doctrine could come from the illustrious defender of non-resemblances?—from the founder of the school which ridicules Locke, Berkeley, and Hume, for supposing that our ideas of primary qualities are resemblances of those qualities?—“ What is the *appearance* of any thing but a *resemblance* of it? An *appearance* of any thing means the highest degree of resemblance; or that precise resemblance of it which makes it *seem to be* the thing itself.”[*] *Appearance*, in Dr. Reid's sense of the term, is precisely assimilated to the *phantasm* of Aristotle.

In reality, neither of these objections against Mr. Locke's theory seem to have weighed very heavy with Dr. Beattie; whose chief ground of controversy is drawn from another source; from Locke's having opposed the Cartesian doctrine of innate ideas and principles: or, in other words, from his having opposed M. Des Cartes's gratuitous assertion that infallible notions of a God, of matter, of consciousness, or moral right, together with other notions of a like kind, are implanted in the mind, and may be found there by any man who will search for them; thus superseding the necessity for discipline and education, and putting savages upon a level with theologians and moral philosophers. To confute this absurdity of M. Des Cartes is the direct object of the first book of the Essay on Human Understanding; “ and it is this first book,” says Dr. Beattie, “ which, with submission, I think the worst and most dangerous.”[†] Here again, however, it is altogether unnecessary for me to offer a vindication, for it has been already offered by one of the most able supporters of the new system, Mr. Dugald Stewart himself; who thus observes, as though in direct contradiction to his friend Dr. Beattie; “ the hypothesis of innate ideas thus interpreted (by Des Cartes and Malebranche) scarcely

[*] Fearne's Essay on Consciousness, ch. xii. p. 247. 2d edit.

[†] Beattie on Truth, part ii. ch. ii. sect. i. § 2.

seems to have ever merited a serious refutation. In England, for many years past, it has sunk into complete oblivion, excepting as a monument of the follies of the learned."*

We have thus far noticed three objections advanced against Mr. Locke's system by the three warmest champions for the new hypothesis. And it is a curious fact that they are almost advanced singly; for upon these three points the three combatants are very little more in harmony with themselves than they are with the Goliah against whom they have entered the lists. There is a fourth objection, however, and it would be the chief and most direct, if it could be well supported, on which the metaphysicians of the north seem to be unanimous. The Essay on Human Understanding resolves all the ideas we possess, or can possibly possess, into the two classes of those obtained by sensation, or the exercise of our external senses, and those obtained by reflection, or the operations of the mind on itself; and it defies its readers to point out a single idea which is not reducible to the one or the other of these general heads. The supporters of the northern hypothesis have specially accepted this challenge, and have attempted to point out a variety of ideas, or CONCEPTIONS, as Dr. Reid prefers calling them, which are in the mind of every man, and which are neither the result of sensation or reflection; and they have peculiarly fixed upon those of extension, figure, and motion. And hence this argument is regarded as decisive, and is proposed, both by Dr. Reid and Professor Stewart, "as an experimentum crucis, by which the ideal system must stand or fall."†

Now, strictly speaking, this invincible argument, as it is called, is no argument whatever. It is a mere question of opinion, whether the above-named ideas, together with those of time, space, immensity, and eternity, which belong to the same class, can be obtained either by means of the external senses of the operation of the mind upon its own powers, or whether they cannot. And, for myself, I completely concur in believing with Mr. Locke that they can: though I am ready to leave this part of the subject, as I am the whole question between us, to Mr. Stewart's own case of the boy born blind and deaf, as communicated to the Royal Society of Edinburgh in the course of last year;‡ who, it is admitted, is possessed of perfect soundness of mind; but who, at that time in his seventeenth year, was, as we are expressly told, without any idea of a being superior to himself; of any religious feelings; and who did not appear to have possessed any moral feelings upon the sudden death of an indulgent father, notwithstanding the utmost pains that had been taken to give him instruction. If this boy shall be found to possess as clear an idea of figure and motion as those who have the free use of their eyes, I will readily allow Mr. Locke's system to be unfounded. That he must have some idea follows necessarily from his system; because he appears to have a very fine touch, and has also, or at least had till very lately, some small glimmering of light and colours.§

But upon the northern hypothesis, he ought not only to have *some idea* of these qualities of bodies, but A MOST TRUE AND CORRECT IDEA, probably more so, instead of less so, than that of other persons; since he is said to obtain it from a faculty which is not supposed to be injured, and since the want of one sense is usually found to strengthen the remainder.

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* Essays, vol. i. p. 117.

† Reid's Inquiry, &c. p. 137. Stewart's Essays, vol. i. p. 549.

‡ "Some Account of a Boy born Blind and Deaf. By Dugald Stewart, Esq. F.R.S. Ed. 4to. Edin. 1812." With which compare, relating to the same individual, "History of James Mitchell, a Boy born Blind and Deaf, &c. By James Wardrop, F.R.S." Ed. 4to. 1813.

§ See Edin. Rev. No. xl. p. 468.

With respect to the idea of extension, indeed, which, by some philosophers, is thought to be most difficult of the whole, it appears to me that it is capable of being obtained with at least as much perspicuity as that of most other qualities of bodies, and more so than ideas of any of them; for we have in this instance the power of touch to correct that of sight, or *vice versâ;* while in a multitude of other instances we are compelled to trust to one sense alone. Extension, in its general signification, is a complex idea, resulting from a combination of the more simple ideas of length, breadth, and thickness; and hence evidently imports a continuity of the parts of whatever subject the idea is applied to; whether it be a solid substance, as a billiard ball, or the unsolid space which measures the distance between one billiard ball and another; the idea of *measure* being, indeed, the most obvious idea we can form of it. In both which cases we determine the relative proportions of the length, breadth, and thickness by the eye, by the touch, or by both: and acquire, so far as I can see to the contrary, notwithstanding all that has been said upon the subject, as clear an idea as we do of substance. It is first obtained, I grant, from the sight or touch of what is solid alone; and it is afterwards made use of in a more abstract form, as a measure of what is unsolid; whence the mind is able to apply it not only to the subject of pure space, but to a contemplation of circles, triangles, polygons, or any other geometrical figure, even though such figures be not present to the senses, and exist alone in its own conceptions.

Extension, by the Cartesian school, was only applied to solid substance, or body; but then they supposed the universe to consist of nothing but solid substance, or body, and that there is no such thing as vacuum, or pure space. Among the Newtonians, who admit space, extension is applied as generally to this latter as to the former; but in order to avoid the confusion to which the application of this term to things so totally opposite as matter and space has produced in common discourse, Mr. Locke advises to appropriate the term *extension* to body, and *expansion* to space; using both these terms, however, as perfect synonyms, and as equally importing the simple idea of *measure;* which, as I have just observed, is the most obvious and explanatory idea that can be offered upon this subject.

Widely different, however, is the opinion of the metaphysical school of North Britain; and hence, in order to account for these abstruse ideas, to which they affirm that neither our senses nor our reason can give rise, as also in order to compel our belief that the external world exists in every respect precisely AS IT APPEARS TO EXIST, and that external bodies possess in themselves all the qualities, both primary and secondary, which THEY APPEAR TO POSSESS, and thus, with one wide sweep, to clear the ground as well of the errors of Des Cartes, Newton, and Locke, as of those of Berkeley and Hume; Dr. Reid, who, at one time, had been a follower of Berkeley, and, as he himself tells us, "had embraced the whole of his system,"* steps forth with his new theory, the more important doctrines of which may be comprised under the four following heads:—

I. There exist in the mind of man various ideas or conceptions, both physical and metaphysical, which we have never derived either from sensation or reflection.

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* See Dugald Stewart's Essays, Note E. p. 548., and compare with ch. i. pp. 62, 63.

II. There must therefore exist, somewhere or other in the animal frame, a third percipient principle, from which alone such ideas can have been derived.

III. From this additional principle there is no appeal: it is higher in its knowledge, and surer in its decision, than either the senses or the reason; it compels our assent in a variety of cases, in which we should otherwise be left in the most distressing doubt; and gives us an assurance, not only that there is an external world around us, but that the primary and secondary qualities of bodies exist equally and uniformly in the bodies themselves, or, in other words, that every thing actually is as it appears to be.

This mandatory or superior principle is COMMON SENSE or INSTINCT.

And in order to ensure himself success in the establishment of the doctrines contained in this outline, Dr. Reid, with a warmer devotion than falls to the lot of metaphysicians in general, and in some degree breathing of poetic inspiration, opens his Inquiry with the following animated prayer: "Admired philosophy! daughter of light! parent of wisdom and knowledge! if thou art she! surely thou hast not yet arisen upon the human mind, nor blessed us with more of thy rays than are sufficient to shed a darkness visible upon the human faculties, and to disturb that repose and security which happier mortals enjoy, who never approached thine altar, nor felt thine influence! But if, indeed, thou hast not power to dispel those clouds and phantoms which thou hast discovered or created, withdraw this penurious and malignant ray: I despise philosophy, and renounce its guidance: let my soul dwell with common sense."

How far this petition was attended to, and the prostrate suppliant was enabled to obtain his object, we shall now proceed to examine.

It is not necessary again to inquire whether the abstruse ideas of extension, figure, and motion, time and space, together with various others of the same kind, can or cannot be derived from mental reflection or external sensation. I have already touched upon the subject, and must refer such of my audience as are desirous of entering into it more deeply to the writings of Locke and Tucker on the one side, and of Reid and Stewart on the other. I shall only observe, in addition, that Mr. Stewart himself admits, with that liberality which peculiarly characterizes his pen, that the ideas or notions of extension and figure, which he somewhat quaintly denominates "the *mathematical affections* of matter," presuppose the exercise of our external senses.* But this being admitted, they ought, if not derived from their immediate action, to be fundamentally dependent upon them.

Let us step forward at once to an investigation of the newly discovered and sublime principle itself, by which all these profundities are to be fathomed, and all the aberrations of sense and reason to be corrected.

Many of my hearers will perhaps smile at the idea that this high and mighty principle is nothing more than *common sense;* but, in truth, the founder and supporters of the northern system seem to have been wofully at a loss, not only what name to give it, but what nature to bestow upon it; and have hence variously, and at times most cloudily and incongruously, described it, and loaded it with as many names and titles as belong to a Spanish grandee or a Persian prime minister.

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* Essays, vol. i. p. 95.

"If," says Dr. Reid, "there are certain principles, as I think there are, which the constitution of our nature leads us to believe, and which we are under a necessity to take for granted in the *common concerns* of life, without being able to give a reason for them, these are what *we* call the principles of COMMON SENSE."*

Upon this passage I shall only, for the present, remark, that the new percipient faculty, which it is the object of the Scottish theory to discover to us, is one, as we have just been told, that is capable of extending its survey far beyond "the *common concerns* of life," and of forming ideas of the *mathematical affections* of matter; and consequently that if the principles of common sense be limited, as they seem to be here, and in my judgment correctly so, to "the common concerns of life," they can never answer the purpose to which this faculty aspires, and for which it is started in the present hypothesis; which demands not only a common sense, but a moral and a mathematical sense; and all essentially distinct from and totally independent of corporeal sensation and mental intelligence.

It is much to be regretted, however, and forms an insuperable objection to the whole hypothesis, that its founders have never been able to agree among themselves upon the nature of their new principle.

"The power or faculty," says Dr. Reid, "by which we acquire these conceptions, (those of extension, motion, and the other attributes of matter,) must be something different from any power of the human mind that hath been explained, since it is neither *sensation* nor *reflection*."†

This is loosely written; for it seems to intimate that there may be conceptions or ideas in the mind derived from or dependent on itself, which are not conceptions or ideas of reflexion: while the phrase ideas of reflexion, as employed in Locke's system, embraces ideas of every kind of which the mind is or can be conscious, and which issue from any powers of its own.

Dugald Stewart gives the same doctrine more correctly as follows, and as a paraphrase upon this very passage: "That we have notions of external qualities which have no resemblance to our *sensations*, or to any thing of which *the mind* is conscious, is therefore a fact of which every man's experience affords the completest evidence, and to which it is not possible to oppose a single objection, but its incompatibility with the common philosophical theories concerning the origin of our knowledge."‡

But the question still returns, from what source then are these insensible, unintellectual notions derived? Where is the seat, and what is the meaning of that COMMON SENSE which is to solve every difficulty? As these philosophers make a boast of their *experimentum crucis*, this is an *experimentum crucis* in return to them; nor does there seem to be an individual through the whole school that is able to work out a solution, or to offer any definite idea upon the subject.

I have already observed upon the looseness of Reid, who, in the passage just quoted, seems still to have a slight inclination to regard this principle of COMMON SENSE as a power of the MIND, and of course as seated in the mental organ; though a power that has not hitherto been explained. In the following passage he seems to regard it as a power of the external senses, and hence as seated in these senses themselves.

"The account which this system (Hume's) gives of our judgment and belief concerning things, is as far from the truth as the account it gives of our notions or simple apprehensions. It represents our SENSES as having no other office but that of furnishing the mind with notions or simple apprehensions of things; and makes our judgment and belief concerning those things to be acquired by comparing our notions together, and perceiving their agreements or disagreements. We have shown, on the contrary, that EVERY OPERATION OF THE SENSES, in its very nature, implies JUDGMENT OF BELIEF as well as simple apprehension.[*]

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* Inquiry, p. 52.

† Reid, ch. v. sect. vii.

‡ Essay, vol. i. p. 549.

Yet, in a third passage, he tells us still more openly, that common sense belongs neither to the mind nor to the corporeal senses, but is "A PART OF HUMAN NATURE WHICH HATH NEVER BEEN EXPLAINED!"[†]

Dr. Beattie, on the contrary, who assigns to the phrase Common Sense a much more scholastic import than Dr. Reid appears to have intended, expressly asserts that Common Sense, as he understands it, signifies "that POWER OF THE MIND which perceives truth or commands belief, not by progressive argumentation, but by an instantaneous and INSTINCTIVE IMPULSE;"[‡] or, as he says on another occasion, "it is INSTINCT and not REASON."[§] While Mr. Stewart, still more decisively, declares it to be the COMMON REASON of mankind;[‖] in express contradiction, however, to Dr. Reid, who as positively declares the principles of Common Sense to consist of those principles which we are under a necessity of taking for granted, without being able TO GIVE A REASON FOR THEM."[¶]

Now, whether this third principle reside in the senses or in the mind, so long as it resides in either of them, and constitutes a part of either of them, the argument which they call their *experimentum crucis* falls instantly to the ground; for the ideas to which it gives rise must be sensitive or mental ideas, or, in other words, ideas of sensation or of reflexion.

Dr. Beattie's expression of *instinctive impulse* resulting from a power of the *mind*, is still more objectionable; for instinct is not a power of the mind, but a power meant to supply the place of a mind where no mind is present, or in energy: and always acting most strikingly where there is least intelligence, as in the lowest ranks of animals: and perhaps still more obviously in plants. This is to confound endowments instead of to discriminate them. Nor is there less confusion in Dr. Reid's account of the matter; which is, "that every operation of the senses implies JUDGMENT and BELIEF, as well as simple apprehension: for this is to transfer the mind itself from the brain to the senses, as well as to make a like transfer of the principle of common sense to the same organs: it is to produce a chaos in the constitution of man, by jumbling every faculty into an interference with every faculty. And yet upon this very doctrine he stakes the whole truth or falsehood of his theory; and Mr. Stewart abets him in the same appeal.[**]

It is amusing, indeed, to run over the names, titles, or distinctive marks assigned to their newly discovered principle by the leaders of the Common Sense school. For we have not only common sense, instinct,[††] instinctive prescience,[‡‡] and instinctive propensity;[§§] but dictates of nature,[‖‖] dictates of internal sensation,[¶¶] simple notions, and ultimate laws,[***] judgment and belief furnished by the senses,[†††] inductive principle,[‡‡‡] constitution of human nature,* common understanding,† moral sense,‡ moral principle,§ suggestions,‖ and, finally, inspiration: thus putting this imaginary power, if not in the place of a Bible, upon an equality with it.

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[*] Inquiry, ch. vii. p. 480.

[†] Ibid. ch. v. lect. iii. p. 115. edit. 1785.

[‡] On Truth, part i. ch. i. p. 11.

[§] Id. part ii. ch. i.

[‖] Essay ii. p. 60.

[¶] Inquiry, p. 52.

[**] Stewart's Essays, vol. i. p. 548.

[††] Beattie, part i. ch. ii. p. 28. stereotype edit. Stewart's Essays, vol. i. pp. 66. 87, 88. 589.

[‡‡] Reid's Inquiry, ch. vi. lect. xxiv. p. 441.

[§§] Beattie on Truth, part i. ch. iii. lect. vii. p. 63.

[‖‖] Ibid. part i. ch. ii. pp. 28. 32.

[¶¶] Ibid. p. 31.

[***] Stewart's Essays, vol. i. essay iii. p. 123.

[†††] Reid's Inquiry, ch. vii. p. 481.

[‡‡‡] Ibid. ch. vi. lect. xxiv. p. 442.

The "original and natural judgments" of this faculty, says Dr. Reid, are the INSPIRATION OF THE ALMIGHTY: "they serve to direct us in the common affairs of life, where our reasoning faculty would leave us in the dark. They are a part of our constitution; and all the discoveries of our reason are grounded upon them. They make up the common sense of mankind, and what is manifestly contrary to any of those first principles is what we call absurd."¶

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* Stewart, essay i. ch. i. p. 7. Reid, p. 391. Principles of the Constitution, Beattie, part i. ch. ii. p. 29. Original Principles of the Constitution, Reid, Inq. ch. vi. lect. xxiv. pp. 428. 441.

† Reid, ch. vi. lect xx. p. 380.

‡ Stewart, essay i. ch. iv. p. 44.; a phrase of Shaftesbury, and adopted from him by Hutcheson.

§ Beattie, part i. ch. ii. 29. ‖ Ibid. essay ii. ch. ii. p. 96. Reid, ch. vi. lect. ii. p. 157.

¶ Reid, ch. vii. p. 482.

In treating of the subject of instinct, I had occasion to notice that Dr. Hancock, in a recent work of much moral excellence, has taken the same generalized view of those various powers, and has directly resolved the whole into an immediate and continual flow of divine inspiration through the agency of the Holy Spirit: so that the lowest animal, in its instincts, and the most gifted saint, in his special illumination, are supplied from one and the same intellectual fountain. And hence, in Dr. Hancock's view, this is a power or energy which not only serves "to direct us in the COMMON affairs of life, where our reasoning faculty would leave us in the dark," but to enlighten us in the sublime mysteries of spiritual truth. "In the same manner as the Divine Being has scattered the seeds of plants and vegetables in the body of the earth, so he has implanted a portion of his own incorruptible seed, or that which in Scripture language is called 'the seed of the kingdom,' in the soul of every individual of the human race."—Essay on Instinct, p. 459. And hence, though Dr. Hancock is obliged to "admit that there are no innate ideas, according to the strict meaning of the term, and no formally inscribed truths, like established propositions to be discovered in early life,—yet it is fair to presume that the rudiments or *inherent propensities* leading to mental and corporeal perfection, are still essentially in existence. Hence, because we cannot discover in the infant mind the manifest signs of an original innate truth or conception that there is a God, and the simple propositions relative to moral and religious duty, we are not to conclude that it has no *tendency* to develope these notions."—Ibid. p. 314, 315.

We have here a clear example of the difficulty of keeping an hypothesis within due limits that has no fixt principles to be built upon. So far, however, as these writers appeal to Scripture in support of their doctrine of a moral sense, or instinctive love of virtue, *propensity* to moral right, internal light or innate idea of God, they seem to be opposed by every page to which they refer. For whatever man may become by a gradual cultivation of his mental powers, or by immediate irradiation from heaven, we are expressly told, what, indeed, we have sufficient proofs of if we look around us, and especially into savage tribes, that by nature his "heart is desperately wicked;" that shortly after the fall, God beheld that "the wickedness of man was great on the earth, and that every imagination of the thoughts of his heart was only evil continually;" that "in the flesh dwelleth no good thing;" that men by nature are under the dominion of sin,—whose power is so great as to constitute as it were a "LAW in the members,—and a law so active and hostile to every *good principle*, as to be for ever "warring against the law of the mind" when enlightened by a divine revelation, and even gifted, as St. Paul was, when he wrote this of himself, as well as of others, with the power of the Holy Spirit. And it is hence St. Paul tells us farther, that mankind, in their natural state, instead of being children of light, with innate tendencies or propensities to good, have a heart at "enmity against God;" and "are children of wrath." Whilst, instead of referring us to any kind of præcognita, inbred notions, or instinctive suggestions, in proof of the existence and attributes of a Deity, St. Paul, like Locke, sends us to the works of nature and of providence; to the world *without* instead of to the world *within* us; and to the exercise of our own senses in relation to them: "for the invisible things of God, from the creation of the world, ARE CLEARLY SEEN, being understood by THE THINGS THAT ARE MADE, even his ETERNAL POWER and GODHEAD." And these proofs are so manifest, and the duties they enjoin so easily deducible, as to form a law of nature, "a law unto themselves," in the minds of those who attend to them, and have no revealed law,—a *conscience* of what is right and wrong; so as to leave the whole world, as he farther adds, "without excuse," for not acquiring this knowledge, and this natural law. It is to the same BOOK OF NATURE, and for the same purpose, that the Psalmist leads himself in Ps. viii. 3. "When I consider the heavens, the work of thy hands: the moon and the stars which thou hast ordained;" and to which he leads every one else, in Ps. xix. 1—3. And to what but the same divine yet external proof does our Saviour lead us in Matt. vi. 28. "CONSIDER the lilies of the field, how they grow," &c. as well as in numerous other places?—external objects generally forming a text to the divine comment of him who "spake as never *man spake*."

Now, what is to be collected from all this pompous heraldry of high-sounding names, so totally inconsistent with the precision of an exact science; and which certainly would not have been allowed had this school been able to settle among themselves, or to communicate to the public, a clear idea of the seat, nature, or attributes of the new, and as I trust to prove, imaginary faculty it thus ventured to introduce; and which, after all, is only intended to supply the place of the innate ideas of M. Des Cartes, as these innate ideas were designed to supply the place of the intelligible world of the Greek schools?

"It is hardly possible for us," says Dr. Beattie, "to explain these *dictates of our nature* according to *common sense* and common experience, in such language as shall be liable to no exception. The misfortune is, that many of the words we must use, though extremely well understood, are either too simple or too complex in their meaning to admit a logical definition."* But the plain fact is, that they have not come to any definite meaning among themselves.† Let us then just give a glance at the two leading terms, for it is hardly worth while to follow up the whole of them. These are *common sense* and *instinct:* both of which seem by Dr. Reid, and in various places by Dr. Beattie and Mr. Dugald Stewart, to be used in their popular import. Can any man for a moment, who has the slightest knowledge of physiology and philology, seriously admit that common sense and instinct are the same thing? or rather ought to be confounded under the same term? Do these writers believe so themselves, whenever they form any clear and precise idea of these faculties in their own minds? "Common sense," says Mr. Dugald Stewart, is "the common reason of mankind:"‡ and every man of common sense will, I suppose, accede to this definition. But common sense, says Dr. Reid, as though in direct opposition to Mr. Stewart, is not reason: for it is that principle which compels us "to take things for granted, *without* being able to give *a reason* for them."§ "Common sense," says Dr. Beattie, "is an instinctive impulse. Common sense is not reason, but instinct. It is instinct, and not reason; that determines me to believe my touch; it is instinct, and not reason, that determines me to believe that visible sensations when consistent with tangible, are not fallacious; and it is either instinct or reasoning founded on experience (that is, on the evidence of sense,) that determines me to believe the man's stature a permanent and not a changeable thing."*

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* Ibid. Part i. ch. ii. 32.

† The phrases KOINAI ΔOΞAI or common sentiments, of Aristotle, Premieres Verites or primary truths of Buffier, or even Innate ideas of Des Cartes, whatever be the truth or fallacy of the doctrines they impart, are far less exceptionable than that of Common Sense, as being far less capable of being misunderstood. Attempts have been made to support this phrase by a reference to its employment by other writers, and even in the Latin tongue; and poets as well as metaphysicians have been brought forward with their suffrages. But all this is to no purpose, unless it could be proved that such writers had used in the same meaning as the chief supporters of the present hypothesis, and that this meaning was one and indivisible. Mr. Stewart has felt himself particularly called upon to admit the loose and unsettled character of Dr. Beattie's language, and especially in one of his accounts of Common Sense, which he declares "is liable to censure in almost every line." Elem. ch. i. lect. iii. p. 83; while Dr. Reid, on the very same subject, has been far more roughly handled both by the English translator of Buffier, and by Sir James Stewart, ibid. p. 88.

"One unlucky consequence," observes Mr. Stewart, "has unquestionably resulted from the coincidence of so many writers connected with this northern part of the island, in adopting, about the same period, the same phrase, as a sort of philosophical watch-word:—that, although their views differ widely in various respects, they have in general been classed together as partisans of a new sect, and as mutually responsible for the doctrines of each other. It is easy to perceive the use likely to be made of this accident by an uncandid antagonist."—Ibid. p. 89.

I have endeavoured as much as possible to avoid being open to any such charge by confining my remarks to a few alone of the pillars of the school before us; and by selecting alone those who, from personal friendship and confidential acquaintance with each other's thoughts, are universally regarded as being both the most accordant and ablest defendants of their hypothesis. And if, among writers so closely united, discrepancies of doctrine or opinion should be frequent and flagrant, the only deduction that can be drawn from so unhappy a fact is, that the hypothesis cannot be made to hold true to itself, and is faulty in its first principles.

‡ Essay ii. p. 60.

§ Inquiry, ch. ii. lect. vi.

Now, the first thing that cannot fail to strike us, on comparing these passages together, is the contradictory definitions they contain; the singular confusion which runs through the whole of them in respect to the three ideas of reason, common sense, and instinct; and the acknowledged difficulty the writers feel of drawing a line between the first and the two last of these principles, upon which, however, the whole system of the new philosophy hinges. Surely "if reasoning, founded on experience," which is the very language of Mr. Locke as well as of Dr. Beattie, be sufficient to determine us, and is probably the principle actually appealed to in one case of external sensation, it may well be sufficient, and be thought the principle actually appealed to in all others.

The next remark that must, I think, occur to every one, is the absurdity of clothing instinct with moral and intellectual powers, with belief and judgment: for we are, in other places, told that this instinct of common sense possesses sentiment and moral sense. Now, all these import the existence of a mind: they import more, for they import mental feeling. And the consequence is, that we must either employ the term instinct without a determinate idea, and in opposite significations at different times, or we must allow to reptiles, and ought to allow to plants, the possession of belief, judgment, and mental feeling, as well as to mankind; for the existence of instinct is still clearer and more powerful in the first two than in the last. I know there is no attendant upon these lectures who finds any necessity for this confusion of ideas: and who does not apprehend perspicuously, from the definitions I have ventured to lay down, and have so frequently had occasion to repeat, the natural distinction between the principles here adverted to. But let a man, if it be possible for him, believe that common sense and instinct are the same thing, can he still farther believe that this is the faculty, call it by which of the two names you please, that is to be an infallible guide in physical and metaphysical, in sensible and intellectual, in moral and theological perplexities; where the finest perception falls short, and the most penetrating mind is overwhelmed? Is it this which is to teach us the *mathematical affections of matter;* and to direct us in our duty towards God, our neighbours, and ourselves? I again refer to Mr. Stewart's own description of the boy, born nearly blind, and wholly deaf, to which I have referred already.

If this high and domineering power be instinct, then let us turn, with due reverence, to those quarters where instinct exists in its fullest perfection; let us pay due homage to the brutal and the vegetable tribes. Let us return to the pretty prattle of the nursery, and learn industry from the ant, and geometry from the bee, and constancy from the dove, and innocence from the snow-drop, and blushing modesty from the rose. Let us hail all these, not indeed as our equals, but as our superiors; as more richly endowed with that "inspiration of the Almighty," which is designed to correct the errors of sense and intelligence, and to soar to sublimities to which these can never attain.

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* Essay on Truth, part ii. ch. i. p. 95.

But let us part with the term INSTINCT, and confine ourselves to that of COMMON SENSE. Why is this idea set up as a distinct principle from reason? as a principle often opposed to it, and always superior to it? Common sense is plain sense: the common judgment of mankind upon subjects of common comprehension, sometimes given intuitively, and sometimes by the exercise of reason, both of which, as I have already shown, are alike mental processes. And Mr. Stewart has hence, as lately noticed, freely denominated it in one place, though in my mind most incongruously with respect to his own system, "the common reason of mankind." Its proper limit is the common concerns of life, and while it confines itself to these it is nearly infallible; for the common constitution of our nature must, in most cases, lead us to one common result. When the legislature of our own country, (in which this principle exists with peculiar force,) appeals to the general voice of the people, it appeals to their common sense. But in doing this, does it appeal to their instinct, or to any other faculty than their common reason, that discursive power, which, by being better exercised here than among other nations, has enriched them with sounder and more general information upon the subject in question?

Common sense, however, must be confined to common subjects. Like the ostrich, it is quick and powerful on the surface, but its wings are not plumed for flight, and it plays a ridiculous part whenever it attempts to soar. When Copernicus, with a trembling hand, first suggested that the sun stands fixed in his place, and all the heavenly bodies move round him, common sense, assuming the philosopher, to which character it has no pretensions, opposed him, and science fell a sacrifice to its conceit. With the same foolish vanity it denied, till laughed out of its folly by circumnavigation, the existence of antipodes; or that the surface of the earth, which appears to be a plane, could be spherical, and that men and women of our own shape and make could exist on its reverse side, with their feet opposed to our own. When the Dutch ambassador told the king of Siam, who had never seen or heard of such a thing as frost, that the water in his country would sometimes in cold weather be so hard, that men might walk and bullocks be roasted upon it, his well-known answer was delivered upon the principles of common sense. He spoke from what he had seen, and from what every one had seen around him, and he relied upon the common appearances of nature. "Hitherto," said he, "I have believed the strange things you have told me, because I looked upon you as an honest man, but now I am sure you are a liar." Yet this is the faculty held up in the system before us as a sure and infallible judge, whose office it is to correct the errors of reason, and to prove to us that every thing exists precisely AS IT APPEARS TO EXIST.*

How much clearer, and to the purpose, is the explanation of this subject given by the excellent Bishop Butler, and how perfectly in unison with the language of Mr. Locke. "That which renders being," says he, "capable of moral government, is their having a moral nature and moral faculties of perception and action. Brute creatures are impressed and actuated by various instincts and propensions: so also are we. But additional to this we have A CAPACITY OF REFLECTING upon actions and characters, and making them an object to our thought; and ON OUR DOING THIS, we naturally and unavoidably approve some actions, and disapprove others, as vicious and of ill-desert. It is manifest that a great part of common language and of common behaviour over the world is formed upon the supposition of SUCH A MORAL FACULTY; whether called conscience, moral reason, moral sense, or divine reason; whether considered as a sentiment of the understanding or as a perception of the heart, or which seems the truth, as including both."[*] Here we have laid down a firm and impregnable basis: it is the capacity of reflection: an arrival at the intrinsic nature of natural and moral good, and natural and moral evil, through the operation of our own reason: that faculty of reason, which the same distinguished writer, instead of despising or undervaluing, expressly calls in another place, after Solomon, "the candle of the Lord;" but which he adds, "can afford no light where it does not shine, nor judge where it has no principles to judge upon."[†]

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* Dr. Beattie has adopted this precise line of reasoning under the influence of Common Sense principles; and points out, by analogy, that the opinion of the Siamese monarch was founded upon a basis which nothing could shake or ought to shake; for the only appeal that any opposing evidence could make to him must have been through the medium of his reason, which is a less infallible judge than common sense, and hence less worthy of attention.—"Common sense," says he, "tells me that the ground on which I stand is hard, material, and solid. Now if my common sense be mistaken, who shall ascertain and correct the mistake? Our reason, it is said. Are then the inferences of reason, in this instance, clearer and more decisive than the dictates of common sense? By no means. I still trust to my common sense as before, and I feel that I must do so. But supposing the inferences of the one faculty as clear and decisive as the dictates of the other; yet who shall assure me that my reason is less liable to mistake than my common sense?—In a word, no doctrine ought to be believed as true, that EXCEEDS BELIEF AND CONTRADICTS A FIRST PRINCIPLE."—On truth, part i. ch. i.

With this remark, I feel that I might safely drop this part of the argument: but as I have referred Mr. Stewart to his own description of the blind and deaf boy, in refutation of his view of the powers and duties of the external senses, I will, in like manner, refer Dr. Reid to Dr. Reid himself in refutation of the doctrine immediately before us, that every thing exists precisely as it appears to exist. In page 173 of his chapter on the quality of colours, he tells us that the *colour* of the body is in the *body* itself—a scarlet rose being as much a scarlet in the dark as in the day; but that the *apparition* or *appearance* of the colour is in the *eye* or the *mind*. But when he tells us this, does he not tell us in as plain terms as can be used, that the *object* and its apparition or *appearance* are in a state of separation from each other? that they are two distinct things, and exist in two distinct places? and consequently that, instead of every thing BEING AS IT SEEMS TO BE, nothing has a being either *as* it seems to be, or *where* it seems to be? Nay, does he not, in spite of himself, adopt the very doctrine of Aristotle and Des Cartes, both of whom held the same tenet? the former, indeed, calling this separate apparition a *phantasm*, which is a mere change of the Latin term apparition into a Greek word.[‡]

But where, let me again ask, is the residence, and what is the nature of this many-titled faculty, which is neither sense nor mind; and is thus capable of discerning what neither sense nor mind can comprehend? Every other principle or faculty has its peculiar seat, and we know how to track it to its form. Instinct is the operation of the power of organized life by the exercise of certain natural laws, directing it to the perfection of the individual; and wherever organized life is to be found there is instinct.—Irritation exists in the muscular fibre; sensation in nervous cords; intelligence in the gland of the brain; for there is its seat, whatever may be its essence. But where is the seat, and what is the nature of this new principle? Is it capable of a separate existence? Does it expire with the body? Or does it accompany and still direct the soul after death? These are important questions; what is the answer to them? Or is there any other to be found than that of Dr. Reid already noticed? "Common sense is a part of human nature which hath never been explained."[*]

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[*] Analogy of Religion, Natural and Revealed: Dissert. ii. of the Nature of Virtue.

[†] Ibid. part ii. Conclusion.

[‡] "The scarlet-rose which is before me is still a scarlet-rose when I shut my eyes, and was so at midnight when no eyes saw it. The *colour remains* when the *appearance ceases:* it remains the same when the appearance changes. To a person in the jaundice it has still another appearance: but he is easily convinced that the change is *in his eye*, and not in the colour of the object. When a coloured body is presented, there is a certain APPARITION *to the eye* or *to the mind*, which we have called *the appearance of colour*. Mr. Locke calls it an idea, and, indeed, it may be called so with the greatest propriety. Hence, the appearance is, in the imagination, so closely united with a quality called a scarlet colour, that they are apt to be mistaken for one and the same thing, although they are in reality so different and so unlike, that one is an idea in the mind, the other is a quality of body."—Inquiry, &c. ch. vi. lect. iv. pp. 172, 173. 175. edit. iv. Lond. 1785.

And what, after all, is it designed to teach us? What is the number and the precise character of those primary maxims, or instinctive notions, or natural dictates, or inspired truths, or whatsoever else they may be called, which form the sum of its communication? How are we to know what is a genuine and infallible first principle from what has the mere semblance of one and is spurious? Are the founders of the system agreed upon this subject among themselves? If so, they are far more fortunate than the Cartesians upon the first principles, the κοιναι εννοιαι of their own school. If they be not, their foundation slips from them in a moment, and all is wild and visionary; and every one may find a first principle in what his own fancy may suggest, or his own inclination lead him to. Yet we have no proof that any such convention has ever been settled; nor has any individual been bold enough to furnish a catalogue from the repository of his own endowment.

In few words, the whole of this hypothesis is nothing more than an attempt to revive the Cartesian scheme, so far as relates to, perhaps, the most obnoxious part of it, the doctrine of innate ideas, but to revive it under another name. Beattie and Stewart have in fact indirectly admitted as much, though neither of them have chosen to avow the design openly. The worst and most dangerous part of Mr. Locke's system, in the opinion of Dr. Beattie, is his first book—that very book in which this doctrine meets with its death blow. While Mr. Stewart, notwithstanding the contempt with which he professes to treat this fanciful tenet of innate ideas, asserts almost immediately afterwards, that his chief objection to it consists in its name, and the absurdities that have been connected with it;[†] and adds, that "*perhaps he might even venture to say*," if separated from these, it would agree in substance with the conclusion he had been attempting to establish.[‡]

It was my intention to have pursued this hypothesis in another direction, and to have pointed out its decisive tendency to an encouragement of mental indolence and immorality; a tendency, however, altogether unperceived by the uncorrupt and honourable minds of its justly eminent leaders. But our time has already expired, and I must leave it to yourselves to calculate at home, what must be the necessary result of a theory, provided it could ever be seriously embraced upon an extensive scale, that teaches, on the one hand, that intelligence is subordinate to instinct, and that our truest knowledge is that which is afforded by the *dictates of nature*, without trouble or exertion; and on the other, that our *moral sense* is identical with our *instinctive propensities*; and that the *constitution of our nature* is an infallible guide, and can never lead us amiss. This mischievous, but unquestionably unforeseen tendency of the theory of common sense, I must leave you to follow up at your leisure; but I cannot quit this subject without once more adverting to the total failure of this theory, in accomplishing the chief point for which it was devised,—I mean that of engaging us to believe, in opposition to the philosophical vagaries of the Bishop of Cloyne and Mr. Hume, as well as of the earlier idealists, not only that the external world has a substantive existence, but that it substantively exists in every respect as it APPEARS to exist. I have already observed, that while Dr. Berkeley was contending metaphysically that we have no proof of a material world, because we have no proof of any thing but the existence of our own minds and ideas, M. Boscovich was contending physically that we have no proof that matter contains any of the qualities which it APPEARS to contain; that whatever the OSTENSIBLE FORMS of bodies may present to us, it has in itself no such properties as they *seem* to exhibit; that the whole visible creation is nothing more than a collection of indivisible, unextended atoms, or mere mathematical points, whose only attributes are certain powers of attraction and repulsion, and consequently that every thing we behold is A MERE PHÆNOMENON,—AN APPARITION, and nothing more.

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[*] Inquiry, ch. v. sect. iii. p. 115.

[†] Essay iii. p. 120.

[‡] "Perhaps I might even venture to say that, were the ambiguous and obnoxious epithet *innate* laid aside, and all the absurdities discarded which are connected either with the Platonic, with the Scholastic, or with the Cartesian hypothesis, concerning the nature of *ideas*, this last theory ("the antiquated theory of innate ideas," as he has just above called it, and to which he here refers,) would agree in substance with the conclusion which I have been attempting to establish by an induction of facts."—Phil. Essay iii. p. 120. 4to. 1810.

Now, meaning to oppose this doctrine, and every doctrine of a similar import, could it be supposed possible, if the fact did not stare us in the face from his own writings, that Dr. Reid would after all avow and contend, not indeed for the same but for a parallel tenet, and support it almost in the same terms? Could it be supposed that he would tell us, as we have already seen he has told us, that every object has its APPARITION; that the object is one thing and its APPARITION another; that the object is IN ONE PLACE and its apparition IN ANOTHER; and that neither the mind nor the eye behold the object itself, but only its APPARITION, or APPEARANCE, its PHANTASM OF PHÆNOMENON?

But I have to draw still more largely upon your astonishment; for it yet remains for me to inform you, that Mr. Dugald Stewart, who may be regarded as the key-stone of Dr. Reid's system, and the chief aim of whose writings has been to proscribe the hypothesis of Berkeley, has himself fallen, not unintentionally, as Dr. Reid seems to have done, but openly and avowedly, into a modification of Boscovich's hypothesis; and has even brought forward its more prominent principles "as necessary," I adopt his own terms, "to complete Dr. Reid's speculations."* He labours, indeed, to prove, that the two hypotheses, of Berkeley and Boscovich, have no resemblance or connexion with each other; and I am ready to admit, that in some respects there is a difference, since Boscovich allows us a visionary material world, a world of apparitions, or orderly phænomena, in the language of Leibnitz *phenomenes bien réglés*, while Berkeley allows us no material world whatever; though he, too, has his world of phænomena: but I must contend that they are, to all intents and purposes, alike in their opposition to that tenet, which it is the leading feature of Reid's theory to establish,—I mean that we have an internal principle, that proves to us that the world around us is not a vain SHOW but a solid REALITY, and that every thing actually is as it appears to be. So that the theory before us, even in the hands of its founder and principal supporter, has strikingly failed in the object for which it was devised; and, for all the purposes in question, the former might just as well have continued in the profession of Bishop Berkeley's principles, as have deserted them, and set up a new scheme for himself.

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* Essay ii. ch. ii. p. 80., and compare with ch. i. pp. 62, 63.

Under these circumstances I must leave it to the enlightened audience before me, to choose out of these different hypotheses as they may think best. For myself I freely confess, that I have no ambition to soar into the higher rank and the infallible knowledge of an instinctive creature, and shall modestly content myself with the humbler character of a rational and intelligent being, still steadily steering by the lowly but sober lamps of a Bacon, a Newton, a Locke, a Butler, a Price, and a Paley, instead of being captivated by the beautiful and brilliant, but vacillating and illusive, coruscations of these northern lights.

LECTURE VII.

ON HUMAN HAPPINESS.

It has required, I apprehend, but a very slight attention to the course of study we have lately been following up, to be convinced of the truth of the remark with which we opened the series,—I mean, that the subject it proposed to discuss is, of all subjects whatever that relate to human entity, the most difficult and intractable. And absurd and visionary as have been many of the opinions, which it has brought before us, let us, in conclusion, check all undue levity, by recollecting that they are the absurdities and visions of the first philosophers and sages of their respective periods; of the wisest, and, with a few exceptions, of the best of mankind; to whom, in most other respects, we ought to bow with implicit homage, and who have only foundered from too daring a spirit of adventure, and amidst rocks and shoals which laugh at the experience of the pilot.

For myself, I freely confess to you, that my own hopes of success are but very humble. I have done my best, however, to render the subject intelligible; and if in the progress of it I should also have betrayed dreams and absurdities, I have only to entreat that they may be visited with the candour which I have endeavoured to extend to others; fully aware that the ablest arguments I have been able to submit are not fitted, if I may adopt the eloquent words of Mr. Burke, "to abide the test of a captious controversy, but of a sober, and even forgiving examination; that they are not armed at all points for battle, but dressed to visit those who are willing to give a peaceful entrance to truth."

There is one point, however, and the most important point we have contemplated, in which all the different schools seem to be agreed,—I mean, that of moral distinctions. Whatever may be the roads the different travellers have lighted upon, whether short or circuitous, smooth or entangled, they all at last find themselves, in this respect, arrive at the same central spot; and coincide in prescribing the same rules of duty, enjoining the same conduct, and, with a few exceptions, delivering the same determinations. No philosopher in the world has ever dreamed of confounding virtue with vice, or of writing a treatise on the benefit of committing crimes. Let us search where we will, we shall find that there is a something in human nature, when once emerged from the barbarism of savage life, that leads the learned and the unlearned to approve the one and to condemn the other, even where their own conduct is involved in the condemnation.

And what is this something in human nature that conducts to so general a conclusion. A set or system of innate ideas and first principles, replies one class of philosophers; a moral instinct or impulse of common sense, replies another class; the intrinsic loveliness and beauty of virtue itself, replies a third; because the attributes of virtue are useful and agreeable either to ourselves or to others, replies a fourth; because it conducts to human happiness, replies a fifth; and because it is the will of God, replies a sixth.

But while all thus agree in the conclusion, the question that leads to it still returns upon us: What proof have we of the existence of such innate ideas or instinctive impulse; of the intrinsic beauty of virtue; that it is useful to us, productive of our happiness, or that it is the will of God it should be cultivated; or rather, what proof have we that the original position is true, and that there is a something in human nature in general which induces us to prefer virtue to vice.

The original position is true, but the reasons urged in support of it are neither equally true nor equally adequate, even where they are true.

It is not true that we have either innate ideas or moral instincts that impel us to a love of virtue; for in such cases the most savage tribes among mankind would be the most virtuous; their præcognita, or innate ideas, being but little disturbed by foreign ideas, acquired by education or extensive commerce with the world; and their moral instincts as little disturbed by foreign habits acquired from the same causes.

There has often arisen in the mind an unaccountable whim, of supposing that a savage life, or state of nature, is the best and purest mode of human existence; and novellists, poets, and sometimes even philosophers, have equally ranted upon the paucity of its wants, the simplicity of its pursuits, the solidity of its pleasures, and the strength and constancy of its attachments. It is here, we have been told, that the human soul developes its proper energies, and displays itself in all its native benevolence and dignity: here all things belong equally to every one; the only law is the will of the individual, the only feeling a sublime, unselfish philanthropy. This whim became epidemic in France about the beginning of the French Revolution, and was, in fact, the monster mania that led to it. And the contagion, not long afterwards began to show itself among many individuals of our own country, who, in the height of their phrenzy, laboured earnestly to promote the same kind of trials among ourselves that our neighbours were actually exhibiting. The history is fresh in the minds of every one, and it is not necessary to pursue it. It is sufficient to observe, that it led in a short time to consequences so mischievous as to work their own cure; and to afford another living proof of the fact I endeavoured pointedly to establish in a late lecture, that barbarism, vice, and misery are, by an immutable law of nature, the inseparable associates of each other.* Throw your eyes to whatever part of the globe or to whatever history of mankind you please, and you will find it so without an exception. Other animals have instincts that control their appetites, and lead them insensibly to the perfection of their respective kinds; that inculcate constancy where constancy is necessary, and compel them to provide for and take the charge of their young. Man has no such instincts whatever: he has reason, indeed, a more ennobling and efficient faculty, but it must be called forth, for it is a dormant principle in savage life. And hence, destitute of the one, and uninfluenced by the other, he is the perpetual slave of his ungoverned and ungovernable passions, and is the only animal in the world that has been known to kill or abandon its own offspring in a state of destitute and helpless infancy; and to murder its own kind for the purpose of feasting upon it: a fact too well established to be doubted of; and which, instead of being confined to a single climate or a single people, has apparently been common to all countries when under the influence of gross barbarism; which still exists among various tribes in Africa, South America, and Australia, and particularly among the islands of the South Sea, and which, according to the concurrent testimony of the best Greek and Roman writers, as Herodotus, Pliny, Strabo, and Pomponius Mela, was formerly to be traced among the Scythians, Tartars, and Massagetæ of Asia, and the Lestrigons of Europe. Strabo, indeed, ascribes the same practice even to the Irish in his day, and Cælius Rhodriginus to their neighbours of Scotland; while Thevenot asserts that, when he was in India in 1665, human flesh was publicly sold in the market at Debca, about forty leagues from Baroche.

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* Ser. II. Lect. XIII.

Consentaneous to this view of the subject are the following remarks of one of the most intelligent circumnavigators of the present day, M. Von Langsdorff, which he gives as the result of a personal and comprehensive survey of different climates and countries:—"There is no creature upon the earth, in any climate or zone, that bears such an enmity to its own species as man. Let us only," says he, "cast our eyes over the history of the globe, in the most barren wastes, and in the most fertile countries, in the smallest islands, or on the most extensive continents, among the most savage as well as the most cultivated nations, in short, in every part of the world, wherever man exists, and we shall find him seeking to destroy his own species: he is every where *by nature* harsh and cruel. The observations we made upon these newly discovered islands (the Polynesian), which never, to the best of our knowledge, had any intercourse with civilized nations, and whose inhabitants may be considered as children of nature, and as still in their original condition, afford remarkable examples in confirmation of these assertions.

"The sweet and tender feelings of affection and love, of friendship and attachment, even that of parents towards their children, and of children towards their parents, I have, alas! very seldom found among a rude and uncivilized people. The African hordes not only bring their prisoners taken in battle but their own children to market. The same thing is done by the Kirgis, the Kalmucs, and many other inhabitants of the north-western coast of America; and here at Nakatiwa (one of the islands of the South Sea) a woman would very readily have given a child at her breast, which had been asked by us in jest, in exchange for a piece of iron."* And he might have added, that it was the exposure of British, or rather perhaps of Saxon children for slaves in the public market at Rome, as late as the close of the sixth century, expressly sold for this purpose, by their own parents at their own homes, that first induced that excellent prelate, Pope Gregory I., to plan a mission for the conversion of our barbarous forefathers to Christianity, from the horror he felt at their conduct, and the pity with which he beheld the little outcasts.

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* Von Langsdorff's Voyages and Travels, ch. vii. p. 139.

In the view of history, therefore, as well as in the language of Scripture, man, in a state of nature, is prone to evil, and his heart is desperately wicked: or as it is given most exquisitely in the poetical language of the Psalmist,

> "Behold the dark places of the earth
> Are full of the habitations of cruelty!"*

The sentiment, then, that exists in human nature in favour of virtue, or a virtuous conduct, though general, is not universal, and consequently cannot proceed from any original instincts or innate ideas. What, then, are the other causes to which it has been ascribed by moralists? The intrinsic loveliness of virtue itself. Because its attributes are generally useful and agreeable. Because it conducts to human happiness. Because it is the will of God.

Now all these answers, however diversified, may be resolved into two general ideas—human happiness and the will of God: for we can only regard that as lovely or an object of love which contributes to our happiness: and we can only regard that as useful or agreeable which conduces to the same end.

The subject, therefore, becomes considerably narrowed, and the only substantial replies that appear capable of being given to the question, What is the source of this general settlement among mankind in favour of virtue? are, Because it is the path to happiness: or, Because it is the will of God.

But may not the subject be still farther narrowed, and both these replies be resolved into one identical proposition? may not human happiness and the will of God be the same thing? If so, we shall then only have to inquire farther, whether virtue be the real path to human happiness? for if it be, then, necessarily, he who pursues that path obeys the will of God.

Both questions are important: the first, however, may be settled in a few words. To discover the will of an intelligent agent, nothing more is necessary than to examine the general drift or tendency of his contrivance, so far as we are able to make it out. Taking it, then, for granted, that the world is the work of an intelligent agent, does it exhibit proof of having been devised for the general accommodation and happiness of man? for his general misery,—or for neither? It cannot have been devised for neither, because that would be to relinquish the very foundation of our present position, and to deny that the world exhibits contrivance, or has been formed by an intelligent agent? Is, then, the world, with its general furniture, is the frame of man itself calculated to promote man's happiness or his misery? It is impossible to answer this question more strongly than in the words of Archdeacon Paley:—

"Contrivance proves design, and the predominant tendency of the contrivance indicates the disposition of the designer. The world abounds with contrivances; and all the contrivances with which we are acquainted are directed to beneficial purposes. Evil, no doubt, exists; but is never.

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* Psalm lxxiv. 20.

taht we can perceive, the object of contrivance. Teeth are contrived to eat, not to ache: their aching now and then is incidental to the contrivance, perhaps inseparable from it; or even, if you will, let it be called a defect in the contrivance; but it is not the *object* of it. This is a distinction which well deserves to be attended to. In describing implements of husbandry, you would hardly say of the sickle that it is made to cut the reaper's fingers, though from the construction of the instrument, and the manner of using it, this mischief often happens. But if you had occasion to describe instruments of torture or execution, this engine, you would say, is to extend the sinews; this to dislocate the joints; this to break the bones; this to scorch the soles of the feet. Here pain and misery are the very *objects* of the contrivance. Now, nothing of this sort is to be found in the works of nature. We never discover a train of contrivance to bring about an evil purpose. No anatomist ever discovered a system of organization calculated to produce pain and disease; or in explaining the parts of the human body, ever said, this is to irritate; this to inflame; this duct is to convey the gravel to the kidneys; this gland to secrete the humour which forms the gout. If by chance he come at a part of which he knows not the use, the most that he can say is that it is useless. No one ever suspects that it is put there to incommode, to annoy, or to torment. Since, then, God has called forth his consummate wisdom to contrive and provide for our happiness, and the world appears to have been constituted with this design at first, so long as this constitution is upholden by him, we must in reason suppose the same design to continue."*

A thousand other examples might be added, but it is unnecessary. The conclusion is clear, and it is most important: we obtain from the light of nature, or the exercise of our own reason, irresistible proofs of the divine benevolence, irresistible proofs that God has made man to make him happy: or, in other words, that human happiness is the will of God.

We are now, then, prepared to enter upon our last question: Is a course of virtue the path to happiness, for if it be, it must necessarily be the will of God to walk in it? Or, having proved the terms to be co-ordinate, we may propose the question conversely, Is a course of virtue the will of God? For if it be, it must necessarily conduct to human happiness. Under either view of the question, the general proposition will be as follows: God has willed human happiness, and he has willed it to be obtained by a course of virtue. God, then, is the author, happiness the end, and virtue the means.

Let us take the question before us in its first view, Is human virtue the means of human happiness?

Had we time it might perhaps be expedient to enter into a definition of the terms; but we have not time, and I must refer therefore to the general understanding of mankind upon this subject: which I may do the more safely, because, though the terms virtue and happiness are strikingly comprehensive, there is no great difference of opinion either among the learned or the unlearned concerning their general outlines or more prominent characteristics.

The question, then, ought to be argued in relation to the happiness both of the individual and of the community; or, in other words, to the happiness of man in his private and his social capacity.

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* Mor. and Pol. Phil. vol. i. ch. v.

Is the practice of virtue most contributory to a man's individual happiness? The libertine says No; and he seeks for it in his mistress, whom he changes as often as he changes his dress. The glutton says No; unless a good city-feast be virtue; for the soul of happiness with him consists in a haunch of venison and a brisk circulation of the bottle. The spendthrift says No: you may as well seek for happiness in a hay-stack: happiness, my dear Sir, you may depend upon it, consists in nothing else than a good stud, and a pack of hounds. The gamester, in like manner, says No; and he directs us to a pack of cards and a pair of dice. Even the miser joins in the general negative, and would fain persuade us that it resides in the meagre and miserable ghost that constitutes his own person, or the meagre and miserable pursuits to which his person is daily prostituted.

Now all these have, no doubt, their respective enjoyments; but do they constitute happiness in any fair sense of the term? are they permanent? I do not say through life, but for four-and-twenty hours together. Many of them, on the contrary, are of that violent kind that they wear themselves out in an hour or two; and what is the state of the system before it recovers sufficient energy for a renewal? To say that it is as empty as an air-pump would be to give a better character of it than it deserves. It is not empty; it is still full; full of bitterness or insupportable languor, sickness at heart or sickness at the stomach. Even the miser, who, properly speaking, provides for a longer range of enjoyment than any of the rest of this precious group, is a victim while he is a worshipper, a sacrifice to anxiety while an idolater of Mammon.

We are at present, however, merely following them up through a single day; but life is a series of days; in its ordinary estimate, of threescore years and ten. And he who is a candidate for happiness must prepare himself, not for a single day, but for the entire term: he must save his strength, and proceed cautiously, for there is no race in which he may so soon run himself out of breath. His motto may perhaps be, "A short life and a merry one;" and this, in truth, is the motto, and not the motto only, but the brief history of most of those whom we have thus far considered. For consumption, dropsy, gout, or chagrin and suicide, make not unfrequently a woful havoc in their ranks before they have cleared two thirds of the pleasurable career they had proposed to themselves. Let them, then, have their motto if they will; but let them not boast that they have found out the specific for making life happy; for all that they have found out is a specific for throwing both life and happiness away at the same time. They have had a few fitful bursts of enjoyment; but the price has been enormous,—a costly birthright for a mess of pottage. He only can fairly boast of happiness, place it in whatever way you please, who, on casting up the account, can honestly say that it has accompanied him through the long run.

There is another and a very different set of people, both in the higher and lower ranks of life, who also occasionally try to persuade themselves that they are happy, and who are sometimes actually thought so by those around them: and these are the listless and idle, who loll and saunter life away as though it were a dream; and who, in truth, are more alive in their dreams than in their waking hours. Now happiness consists in activity: such is the constitution of our nature: it is a running stream, and not a stagnant pool. It shows itself under this form from the first moment it shows itself at all. Behold the happiness of the infant or of the school-boy: he is full of frolic; he cannot contain the current of self-delight: in the bold significancy of vulgar language, it runs out at his fingers' ends. Upon the whole, the listless and idle have less pretensions to happiness than the characters we have just surveyed,—the libertine, the gamester, and the spendthrift: for should you distil the aggregate of insignificant incidents that compose the whole tenour of the feeble life of the former, not a drop, perhaps, of the essence of happiness would ascend in the alembic. They may be at perfect quiet if you please, and look fat and in good liking, but this is not happiness; for if so, capons and Cappadocian slaves would have a better title to it than themselves.

Let us now apply these observations to the question before us. No man can be happy without exercising the virtue of a cheerful industry or activity. No man can lay in his claim to happiness, I mean the happiness that shall last through the fair run of life, without chastity, without temperance, without sobriety, without economy, without self-command, and consequently without fortitude; and, let me add, without a liberal and forgiving spirit. The whole of this follows as the necessary result of our argument. The exercise of these virtues may perhaps cost a man something at the time, but the full scope and aggregate of his happiness depend upon the exercise. It is a tax upon the sum-total, that must be regularly paid to secure the rest. And it ought never to be forgotten that we are so much the creatures of habit that the more we are accustomed to the exercise, like an old garment, the easier it will sit upon us.

But these are private virtues, and only a few of them. Man has also, if he would be happy, to practise a still longer list of public virtues; and he cannot be happy without practising them. Or, in other words, (for I am now to consider him in a social capacity,) the happiness of the community to which he belongs, and of which his own forms a constituent part, could not continue without his practising them.

He may steal, indeed, from his neighbour, and hereby increase his means of gratifying some predominant passion; but then his neighbour may also steal from him in return, and to a greater extent; and his happiness therefore (ever regarding it in the aggregate) is connected with his exercising the virtues of justice and honesty. He may break his promise, or lie to his neighbour, upon a point in which his own interest appears to be concerned; but then his neighbour may also return him the compliment, and in a way in which his interest may be still more deeply concerned; and his interest, therefore, or, which is the same thing, his happiness, obliges him to practise the virtue of veracity.

In Woodfall's edition of the Letters of Junius, there is a passage upon the subject before us, contained in one of his private letters, which has peculiarly struck me, considering the quarter it has proceeded from, and the manner of its communication. Whoever was the writer of these celebrated Letters, it will be readily admitted, that he had a most extensive acquaintance with men of all ranks and characters, particularly with the vicious and profligate; and that he had a most extraordinary facility of penetrating into the human heart. In the private letter I refer to, he unbosoms himself to his printer, for whom he appears to have had a great esteem, and, amidst the regulations he gives him for his future conduct, makes the following forcible remark: "With a sound heart be assured you are better gifted, even for worldly happiness, than if you had been cursed with the abilities of a Mansfield. After long experience of the world, I affirm, before God, I never knew a rogue who was not unhappy."*

It is not necessary to pursue the catalogue. Man is by nature a social being: every one is purposely made dependent upon every other; and consequently the happiness or well-being of the whole and of every one, who constitutes an integral part of the whole, must be the same happiness. Yet as the happiness or well-being of the individual demands, in his private capacity, as we have already seen it does, a system of private abstinences, or restraints, the happiness or well-being of society demands a more extensive system of public duties of the same kind. We must consent to relinquish a part of our liberty, a part of our property, a part of all our personal propensities and appetites, or the well-being of the society to which we belong, and consequently our own social well-being could not continue. We may indeed take ourselves away from society, and live in the solitude of forests; but our happiness is bound up in social life, and, whatever is the cost, it is consistent with the same happiness that we pay it.

Freethinkers are accustomed to sneer at the precepts of the Bible, which inculcate upon us the virtues of self-denial and mortification in the present life, in order to our making sure of a life of uninterrupted happiness hereafter. But if there be any degree of truth in the remarks now offered, they find themselves called upon to practise a similar restraint and denial even in the purchase of present enjoyment. And the analogy is so striking between the natural and the moral government of the Deity in this respect, that Bishop Butler has forcibly laid hold of the same argument, not only in vindication of the Gospel-precepts upon this point, but in illustration of the paramount importance of our attending to them, if we would be wise to our future and everlasting interest. "Thought," says he, "and consideration, the voluntary denying ourselves many things which we desire, and a course of behaviour far from being always agreeable to us, are absolutely necessary to our acting even a common decent and common prudent part, so as to pass with any satisfaction through the present world, and be received upon any tolerably good terms in it. Since this is the case, all presumption against self-denial and attention to secure our HIGHER INTEREST is removed. The constitution of nature is as it is. Our happiness and misery are trusted to our conduct, and made to depend upon it. Somewhat, and, in many circumstances, a great deal too, is put upon us either to do or to suffer, as we choose. And all the various miseries of life which people bring upon themselves by negligence and folly, and might have avoided by proper care, are instances of this; which miseries are, beforehand, just as contingent and undetermined as their conduct, and left to be determined by it."†

It is from this common consent to put a restraint upon our personal feelings in the pursuit of relative pleasures, from this social impulse of our constitution with which we are so wisely and benevolently endowed, that every man belonging to the same state or community becomes a part of every man, and cannot, even if he would, be an indifferent spectator of the wo or the weal of his neighbour. And hence arises the sacred bond of sympathy or fellow-feeling;

And true self-love, and social, are the same.

While as the line is drawn still closer, and we associate together more frequently and more intimately, we become, from the great and powerful principle of habit, still more kindred parts of each other. And hence the origin of the higher public virtues of patriotism, generosity, gratitude, friendship, conjugal fidelity, parental love, and filial reverence; the exercise of all which in our relative situations of life, whether we contemplate it at the time, or whether we do not, is by our own constitution, or, which is the same thing, by the will of the great Creator, rendered essential to our individual happiness.

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* Letter, No. xliii.

† Analysis of Religion, Natural and Revealed, part i. ch. iv.

Mr. Pope, from a hint furnished by Dr. Donne, finely compares this origin and spread of the different circles of private and public virtues from the salient point of self-love, or the desire of individual happiness in the breast, to the series of circles within circles excited on the bosom of a still and peaceful lake by the throw of a pebble; while all nature smiles around, and, from this very agitation, the face of the heavens is reflected with an additional degree of lustre.

> "Self-love but serves the virtuous breast to wake,
> As the smooth pebble stirs the peaceful lake.
> The centre mov'd, a circle strait succeeds,
> Another still, and still another spreads.
> Friend, parents, neighbour, first it will embrace,
> Our country next, and next all human race.
> Wide, and more wide, th' o'erflowing of the mind
> Takes every creature in of every kind.
> Earth smiles around, in boundless beauty dress'd;
> And heav'n reflects its image in his breast."

We stand in need, then, of no præcognita or innate ideas, of no fanciful instinct whatever;—arguing as intelligent beings, and fairly exercising the discursive faculty of reason, we come to the clear conclusion that virtue is the path to human happiness. The case, indeed, is so manifest, that while many of the instincts we actually possess are often tempting us against such a conduct and such a conclusion, whenever reason is appealed to, we never fail to return to the same established dictum.

The Stoics, with a sort of romantic refinement, pretended to have fallen into a love of virtue for her own sake; and to *sustain* and to *abstain*, to *bear* and *forbear*, to be patient and continent, comprised the summary of their moral system. But while they were thus enraptured with the means, like every other society of mankind, they had the full advantage of the end. They may, indeed, have practised virtue for the love of virtue, but they also practised virtue, and reaped the benefit of their own happiness.

The Epicureans, on the contrary, regarded all these sublime pretensions as mere cant and affectation. They also enjoined and practised, and notwithstanding the false reproach that has attached to their name, enjoined and practised with more rigidity than even the Stoics, the laws and restraints of moral virtue; yet boldly and unequivocally avowed that it was chiefly as a mean towards an end: that it was not so much from a love of virtue, as from a love of pleasure or happiness: and hence pleasure and happiness were in this school used as synonymous terms, as were also vice and folly, and wisdom and virtue; or, rather, wisdom was regarded as the first of all virtues, as being that which teaches us that a life of real pleasure or happiness is to be obtained alone by the exercise of the general cluster of virtues. In one of his letters to Menæceus, that has yet survived the ravage of time, Epicurus has a passage upon this subject peculiarly striking, and that cannot be too strongly impressed on our memories. "Wisdom," says he, "is the chief blessing of philosophy, since she gives birth to all other virtues which unite in teaching us, that no man can live happily who does not live wisely, conscientiously, and justly; nor, on the other hand, can he live wisely, conscientiously, and justly, without living happily: for virtue is inseparable from a life of happiness, and a life of happiness is equally inseparable from virtue. Be these, then, and maxims like these, the subjects of thy meditation, by night and by day, both when alone and with the friend of thy bosom; and never, whether asleep or awake, shalt thou be opprest with anxiety, but live as a god among mankind."*

To the same effect Cassius, in an expostulatory letter to his friend Cicero, who had shown some inclination to join in the general calumny against the Epicureans: "Those whom we call lovers of pleasure are real lovers of goodness and justice; they are men who practise and cultivate every virtue; for no true pleasure can exist without a good and virtuous life."

So Lucretius, when describing the different tribes of the sons of vice, or offenders against the public law, characterizes them by the common name of fools. "They are," says he, "perpetually smarting, even in secret, beneath a sense of their atrocious crimes, and that reward of their guilt, which they well know will sooner or later overtake them:

> The scourge, the wheel, the block, the dungeon deep,
> The base-born hangman, the TARPEIAN cliff,
> Which, though the villain 'scape, his conscious soul
> Still fears perpetual; torturing all his days,
> And still foreboding heavier pangs at death.
> Hence earth itself to FOOLS becomes a hell.†

It was from the elegant and ornate moralists of the East, that the philosophers of this school derived this figurative synonymy; from Arabia, Egypt, and India; in all which quarters we find it still more frequent and familiar. Solomon, whose early studies were derived from an Arabic source, is peculiarly addicted to this use of these terms. The very commencement of his book of Proverbs, or system of ethics, as the schools would denominate it, affords us a striking instance:—

> "The fear of Jehovah is the beginning of knowledge:
> For FOOLS despise wisdom and instruction."

So Vishnusarman, in his Hitopadesa to the same precise effect; "Many who read the Scriptures are *grossly ignorant;* but he who *acts well* is a truly LEARNED man."‡

Whatever view, therefore, we take of this subject, in whatever way we exercise our reason upon it, we cannot fail to approve of virtue in preference to vice; for we cannot fail to regard virtue as the only sure road to happiness, and consequently as the path of wisdom, or the will of God. The case, indeed, is so clear, that it is seldom mankind in any part of the world are now-a-days at the trouble of debating the subject. There is no controversy—the result is taken for granted. And hence wherever education exists, or, in other words, wherever civilized life extends, we are chiefly taught it, not as a science, but as a rule of action; we imbibe it as a habit; and our first and finest feelings co-operate with our best reason in its favour. We form an abstract picture of it in our minds, and delineate it, under the correct and pleasing image of the fair, the needful, the sovereign good. We have already seen that, in proportion as society is ignorant, men are wicked; in proportion as it becomes wise, they grow virtuous. They acquire clearer ideas of right and wrong, which are obviously nothing more than virtue and vice, under an additional set of names, or in a state of activity. And were the rules and laws of right, virtue, or wisdom to be constantly adhered to, or, in other words, the will of the Deity to be fully complied with, there can be no question that mankind, even in the present state, would enjoy all the happiness their nature will allow of; and that a kind of paradise would once more visit the earth.

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* Diog. Laert. x. 132. 135.

† Verbera, carnufices, robur, pix, lamina, tædæ:
Qui tamen et si absunt, at mens, sibi conscia factis,
Præmetuens, adhibet stimulos, torretque flagellis
Nec videt interea, qui terminus esse malorum
Possit, quive sciet pœnarum denique finis;
Atque eadem metuit magis, hæc ne in morte gravescant.
Hinc Acherusia fit STULTORUM denique vita.
Lib. iii. 1030.

‡ Sir W. Jones, vi. p. 37.

And why, then, is not the will of the Deity fully complied with? Why, since the consequence is so undoubted, and so beneficial, are not the rules of virtue constantly and universally adhered to?

This is a most important question, as well in itself as in its results.

The will of the Deity, or the entire rules of virtue, are not always adhered to, first, because, as collected from reason or the light of nature alone, they are not, through the whole range of this complicated subject, in all instances equally clear and conspicuous; and, secondly, because in a thousand instances in which there is no want of clearness or perspicuity, there is a want of sanction—of a compulsory and adequate force. The rules of virtue are general, and must necessarily be general; but the cases to which they apply are particular. The case is present and often impulsive, but the operation of the rule is remote, and it may not operate at all; and hence the pleasure of immediate gratification is perpetually unhinging this harmonious system, and plunging mankind into vice with their eyes open.

But civil laws, moreover, or the authority of the social compact in favour of virtue, are not only often inadequate in their force, but they must necessarily, in a thousand instances, be inadequate in their extent. It is impossible for man of himself to provide against every case of vice or criminality that may offend the public; for the keenest casuist can form no idea of many of such cases till they are before him; and if he could, the whole world would not contain the statute-books that should be written upon the subject.

There are also duties which a man owes to himself as well as to his neighbour; or, in other words, human happiness, as we have already seen, depends almost as largely upon his exercise of private as of public virtues. But the eye of civil law cannot follow him into the performance of these duties, for it cannot follow him into his privacy; it cannot take cognizance of his personal faults or offences, nor often apply its sanction if it could do so. And hence, in most countries, this important part of morality is purposely left out of the civil code, as a hopeless and intractable subject. Yet even in the breach of public duties, specifically stated and provided for, it cannot always follow up the offender, and apply the punishment; for he may secrete himself among his own colleagues, and elude, or he may abandon his country, and defy the arm of justice.

There seems, then, to be a something still wanting. If the Deity have so benevolently willed the happiness of man, and made virtue the rule of that happiness, ought he not upon the same principle of benevolence, to have declared his will more openly than by the mere, and, at times, doubtful, inferences of reason? in characters, indeed so plain, that he who runs may read? and ought he not also to have employed sanctions so universal as to cover every case, and so weighty as to command every attention?

As a being of infinite benevolence, undoubtedly he ought. And what, in this character, he ought to have done, he has actually accomplished. He has declared his will by an express revelation, and has thus confirmed the voice of reason by a voice from heaven: he has made this revelation a written law, and has enforced it by the strongest sanctions to which the mind of man can be open:—not only by his best chance of happiness here, but by all his hopes and expectations of happiness hereafter. And he has hence completed the code of human obligations, by adding to the duties which we owe to our neighbour and to ourselves, a clear rescript of those we owe to our Maker. Nor is such revelation of recent date; for a state of retributive justice beyond the grave constituted, as we have already seen, the belief of mankind in the earliest ages of time; and amidst all the revolutions the world has witnessed, amidst the most savage barbarism, and the foulest idolatries, there never perhaps has been a country in which all traces of it have been entirely lost, or have even entirely ceased to operate.

At different periods, and in different manners, the Deity has renewed this divine communication according as his infinite wisdom has seen the world stand in need of it. New doctrines and discoveries, and doctrines and discoveries, too, of the highest importance, but which it is not my province to touch upon in the present place, have in every instance accompanied such renewal, justificatory of the supernatural interposition. But the sanction has, in every instance, been the same: while, and I speak it with reverence, the proofs of divine benevolence have with every promulgation been growing fuller and fuller:—revealed religion thus co-operating with natural, co-operating with the great frame of the visible world, co-operating with every pulse and feeling of our own hearts in establishing the delightful truth, that God is Love; and in calling upon us to love him, not from any cold and lifeless picture of the abstract beauty of holiness, beautiful as it unquestionably is in itself, but from the touching and all-subduing motive, BECAUSE HE FIRST LOVED US.

LECTURE VIII.

ON THE GENERAL FACULTIES OF THE MIND, AND ITS FREEDOM IN WILLING.

In the commencement of the successive series of lectures which I have had the honour of delivering before this respectable school of science, I stated, as it may be recollected by many of the audience before me, that the subject I proposed to discuss would be of considerable extent and variety;—that it would embrace, though with a rapid survey, the whole circle of physics in the most enlarged sense in which this term has been employed by Aristotle or Lord Bacon; and, consequently, would touch slightly, yet, as I hoped, with a correct outline, upon all the more interesting and important features of matter and of mind. It may be remembered, that I proposed to unfold to you the general principles, laws, and phænomena, as far as we are capable of tracing them, of the world without us, and the world within us; to follow the footsteps of nature, or rather of the God of nature, in the gradual evolution of that nice, and delicate, and ever-rising scale of wonders that surround us on every side, from the simplest elements to the most perfect and harmonious systems of visible or demonstrable existences; from shapeless matter to form, from form to feeling, from feeling to intellect; from the clod to the crystal, from the crystal to the plant, from the plant to the animal, from brutal life to man. All this I have endeavoured to accomplish; feebly, and imperfectly, indeed, but I have still endeavoured it with whatever may be the powers that the breath of the Almighty has implanted within me.

But we have not stopped here; having reached in man the summit of the visible pyramid of creation, we have tremblingly ventured to take a glance at the interior of his mysterious structure; we have followed him, with no unhallowed eye, into the temple of the soul; we have amused ourselves, for, after all, it has been little or nothing more, with conjectures about its essence, and have commenced an analysis of those faculties so fearfully and wonderfully planned, which place him at an almost infinite distance from the brute creation, and approximate him to the sphere of celestial intelligences: to that order of pure and happy spirits with whom it is his high prerogative, if not forfeited by his own misconduct on earth, that he shall associate hereafter, and press forward in the pursuit of an infinite and self-rewarding knowledge, and in the fruition of an endless and unclouded felicity.

This last topic, however, we have entered upon, and nothing more: we have noticed, indeed, the general furniture of the mind, and the diversified faculties with which it is endowed, but we have only extended our investigation beyond such notice to the principles of perception, thought, and REASON, or the discursive power; and to those communications, or ideas of objects or subjects, derived externally or from within, upon which the discursive power is ever exercising itself; and which as they are obtained from the one or the other of these two sources, are denominated ideas of sensation or of reflexion.

Now, besides an ability to *perceive*, *think*, or *reason*, we find the mind possest of an almost infinite variety of other attributes or faculties, implanted in it for the wisest and most beneficent purposes. We behold it endowed with consciousness, judgment, memory, imagination; with a power of choosing or refusing; with admiration and desire; hope and fear, love and hatred; grief and joy, transport and terror; with anger, jealousy, and despair. And we behold each of these faculties, as called into action, producing a correspondent effect upon the organs of the body; giving rise to what the painters call EXPRESSION, or the language of the features; and to articulate sounds, or the language of the lips; lighting up the eye, and animating the countenance; invigorating the speech, and harmonizing its periods; or, on the contrary, filling the eye and the countenance with gloom or indignation, and the voice with sighs and bitter rebukes.

The external signs thus produced, and representative of the inward emotion, operate in their turn with a reflex influence, and rekindle in the mind the feelings that have given birth to them. And hence the origin and soul-subduing power of tender or impassioned poetry, or of manly and forcible eloquence; as also the cause why we feel equally hurried away by the classical debates of the senate, and the fictitious distresses of the drama.

We behold, moreover, in different persons, these energetic principles differently modified or associated in every variety of combination: sometimes one of them, and sometimes another, and sometimes several leagued together, peculiarly active, and obtaining a mastery over the rest. And we behold these effects in different instances, from different causes; as peculiarity of temperament, peculiarity of climate, custom, habit, or education. And hence the origin of moral and intellectual character; the particular dispositions and propensities of individuals or of whole nations. Hence one man is naturally violent, and another gentle; one a prey to perpetual gloom, and another full of hope and confidence; one irascible and revengeful, and another all benevolence and philanthropy; one shrewd and witty, and another heavy and inert. Hence the refinement and patriotism of ancient Greece; the rough hardihood of the Romans; and the commercial spirit of Carthage; and hence, in modern times, the silent and plodding industry of the Dutch; the chivalrous honour of the Spaniards of the last century, unpoisoned by the deadly fever of Corsican morality; the restless loquacity and intriguing ambition of the French; and, may I be permitted to add, the high heroic courage, and love of freedom, the generosity and promptitude to forgive injuries, the unswerving honesty and lofty spirit of adventure, that peculiarly signalize the inhabitants of the British isles; all which are subjects that yet remain to be treated of and elucidated, and which seems to promise us an ample harvest of entertainment and instruction.

Let us begin with the mental faculties themselves. These, as we have already seen, are numerous and complicated; so much so, indeed, that it is difficult to arrange and analyze them; and hence, I do not, at the present moment, recollect a single treatise upon the subject which gives us a clear and methodical classification of them. I shall take leave, therefore, to offer a new distribution; and shall divide them into the three general heads, of powers or faculties of the UNDERSTANDING; powers or faculties of ELECTION: and powers or faculties of EMOTION. To the first belong the principles of perception, thought, reason, judgment, memory, and imagination; to the second, those of choosing and refusing, or of WILLING and NILLING, to adopt an old and very expressive metaphysical term, that ought never to have grown obsolete; to the third belong those of hope, fear, grief, and joy, love, hatred, anger, and revenge, or whatever else is capable of moving the mind from a state of tranquillity and rest.

All these are, properly speaking, acts or actions of the mind; yet, as during the operation of the last set, the mind becomes at times irregularly and involuntarily agitated and affected, though by the force of its own attributes, as the voluntary muscles of the body are often thrown into trepidation and spasms by the contraction of their own fibres, metaphysicians, and especially those of Germany, have seemed inclined to restrict the name of mental actions to the operations of the understanding and the will, and to give the name of *affections* or *passions* to those productive of mental emotion: to those transitions of feeling into which the mind is involuntarily hurried by the stimulus of this class of its own powers, and under the stress of which it may thus far be said to be passive; and hence, if I mistake not, the application of the term passions, (which has so much puzzled the metaphysicians,) to certain conditions or powers of the mind, which import activity and exertion. It is upon the same ground, that where the mind is completely subdued, and suffers extreme violence, we employ the term with peculiar emphasis; thus, when a man is raging either with anger or love, he is said pre-eminently to be in a passion, or to entertain a passion; and thus again, but in a far more serious and solemn sense, the Christian world applies the same term in its highest force of signification to the agony of our blessed Saviour.

Now it is the peculiar feature of physiology, and especially as studied upon the principles of induction, that, as far as it has proceeded, it has discovered a general adaptation of means to a proposed end; and has hence placed the doctrine of final causes, as it has been incorrectly, and not without some degree of confusion, denominated—of causes, however, operating to a final intention,—upon a basis too strong to be shaken by the ridicule of many modern philosophers, sheltering themselves under an erroneous construction of Lord Bacon's views upon the subject.* What, then, are the uses or proposed ends of this extensive and complicated machinery of the mind of man? What are the respective parts which its various faculties, in the order in which we have now arranged them, are intended to fulfil, and the means by which they are to operate?

Their object is threefold, and in every respect most important, and admirably calculated to prove the wisdom and benevolence of the almighty Architect: they are the grand sources by which man becomes endowed with knowledge, moral freedom, and happiness; and is hence fitted to run the elevated race of a rational and accountable being. From the powers of the understanding he derives the first; from those of volition or election the second; and from the passions or motive powers the third. Yet never let it be forgotten, that it can in no respect, or at least to no considerable extent or good purpose, possess either the one or the other, unless the mind, as an individual agent, maintain its self-dominion, and exercise a due degree of government over its own forces. This, I think, must be obvious to every one; and it is in this harmonious balance, this equable guidance and control, that the perfection of the human character can alone consist and exhibit itself. Unless the faculties of the understanding be called forth, there can be no knowledge; and unless they be properly directed, though there may indeed be knowledge, it will be of a worse nature than utter ignorance; we shall pluck, not of the mixt tree of the knowledge of good and evil as it stood before the fall, but from the tree of the knowledge of evil alone, without any union or participation of good. In like manner, unless the will and the passions be under an equal degree of guidance, the mind can be neither independent nor happy: a mental chaos must usurp the place of order, and the whole be misrule and confusion.

We are too much in the habit, both in common life and in philosophy, of regarding the faculties of the mind as distinct agents from the mind itself, as though the latter were nothing more than a house or repository for their reception. This is particularly true in respect to the faculty of the WILL; for we are perpetually told that the will operates upon the understanding or the mind; and that unless the WILL be free, the man himself can have no freedom.

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* Causarum finalium inquisitio sterilis est, et, tanquam Virgo Deo consecrata, nihil parit. Such is his celebrated aphorism: bnt the term *inquisitio* does not relate to the subject or doctrine itself, but merely to its being made a branch of physical instead of metaphysical philosophy. The discoveries of modern times have sufficiently shown that Bacon was deceived upon this last point. But it is perfectly clear from other passages in his writings that he did not mean to controvert the doctrine itself. See Stewart's Elements, vol. ii. p. 454.

Now the will, like the memory or the judgment, is a mere power or ability, and freedom is another power or ability; but powers or abilities of one kind cannot belong to or be the property of powers or abilities of another kind: they can only belong to or be the property of some agent, and in this case the mind is the only agent. The question, therefore, whether the will be free, can only mean, if it mean any thing, whether the mind be free, of which the will is a power or attribute; and to the question thus modified, I have no hesitation in stating that the mind is perfectly free to do whatever it wills. I do not say whatever it *desires;* for the DESIRE is a different faculty from the WILL; and though too generally confounded with each other, for the want of clear ideas upon the subject, the two are frequently in a state of direct opposition. Thus a man may desire to fly, but he never wills it; and for this plain reason, that though the action may be a matter of desire, it can never be a matter of volition; for to suppose the will or power of choosing to be exerted upon a subject in which there is no power of choosing, is to suppose an absurdity. In like manner, on the contrary, a schoolboy may will to get his task, though sorely against his desire or inclination, and the timid female for the benefit of her health, may will to be plunged into the cold bath, though with as great reluctance. So when a kind and indulgent father chastises his son for disobedience, the mind, urged by proper motives, consents, and consequently wills it; it prefers inflicting the chastisement to abstaining from it: but while it wills or prefers the punishment, it is so far from desiring it, that it probably hates it more than the child itself does.

It has been said that, in this case, the feeling of desire is still exercised; that the father, though he does not desire the punishment, desires the ultimate good of his child; that the same power of the mind is therefore still in activity, though directed to a different object; and, consequently, that willing is nothing more than desire in a higher range of the scale, or a state of predominant exertion. But this is to confound rather than to simplify the feelings of the mind. Desire is always accompanied with pleasure, and can never be altogether separated from it; for no man can desire that which is wholly and essentially painful. Now, though the father takes a pleasure in the good of his child, he takes no pleasure, but, on the contrary, great and unmixed pain in his chastisement; and unless pleasure and pain be one and the same feeling, we cannot apply the simple idea of desire to both, though that of the will is equally applicable. And hence the will and the desire must necessarily be regarded as different faculties of the mind. In like manner, a person labouring under a severe fit of tooth-ache may say that he desires to have the tooth taken out; but in saying this he does not desire the pain of its extraction, but only the ease which he hopes will follow upon its removal: for he hates the pain, and would avoid it, and have the tooth removed without it, if possible; but he consents to, or wills it, for the sake of that prospective advantage which alone is the object of his desire, as it is also of his will. So that here again, while the desire is limited to the one state of body, the will applies to both, and affords another proof that they are two distinct mental powers. In like manner, Revelation tells us repeatedly, and as strictly as it does emphatically, that God "hath no pleasure or desire in the death of the wicked;" but it tells us also, that God is, nevertheless, effecting, and, consequently, willing, their death or punishment every day.

Freedom of mind, then, or an exercise of the will, is a distinct power or attribute from that of desire, and can only respect actions in which there is a condition of choice. A man standing on a cliff, has a power of leaping twenty yards downward into the sea, or of continuing where he is; and having this option, he is free, and exercises his will accordingly. But he has no power of leaping twenty yards upwards into the air, and it can never become a question with him—a subject of deliberation or option—whether he shall leap upwards or not; and, consequently, as this can never become a question with him, the mind can never will it, and its freedom remains undisturbed.

Here, then, we rest: the mind is free to do whatever it wills. But the ingenuity of man has not been content with letting the subject remain at this point: it has pushed it still farther, and inquired whether the mind is free to will as well as to act after it has willed? and this, after all, is the real drift of the inquiry with which the world has been so long harassed, whether the will itself be free.

This question is a complex one; and its complexity has not always been sufficiently traced out and explained. The mind of every intelligent being can only will, or, in other words, be determined to do or forbear an act by a motive or moving power, and in this respect it is subject to a necessity issuing from the nature of things; but if, as I shall endeavour to show, the mind, by a voluntary operation of some one or more of its other faculties, of itself constitutes the motive, annuls it, or changes it for another, it must necessarily follow, that it has all the freedom of willing, as well as of acting, that an intelligent being is capable of possessing.

Now, the grand aim of every living, and especially of every intelligent being, is good, pleasure, or happiness; for they all, as in the words of the poet, imply the same thing:—

> O Happiness! our being's end and aim,
> Good, Pleasure, Ease, Content, whate'er thy name.

But good, pleasure, or happiness, are generic names for a thousand different objects, each of which is pursued as many different ways, not only by different individuals, but sometimes at different periods, by the very same person. In all these cases we perceive so many different motives or moving powers. Yet whence comes it, not only that different persons but that the same individual should have a different motive or moving power to-day from what he had yesterday, or perhaps only half an hour before?

The cause may, indeed, be some sudden and impetuous gust of passion by which the mind may be stormed and led captive, as by a *coup-de-main;* but it may also be a deliberate determination of the mind itself. And, in truth, this last is the general cause, to which a sudden and impetuous ebullition of the passions forms but a few occasional exceptions. It is this exercise of deliberation that alone renders man a rational and accountable being. All human laws act upon the same principle: they suppose him, (saving the few extreme cases just alluded to) to be under the influence of a controlling judgment, and they reward or punish him accordingly. And such is the force of habit and long association, that we not unfrequently behold the judgment exercising this control, in a mind evidently unsound and wandering; and the cunning maniac concealing a skilful design or a deep-rooted passion till the due moment arrives for executing the one, or gratifying the other.

Now, in all these cases, the determination of the judgment, which forms the motive or moving power, is as much a voluntary act of the mind, whether right or wrong, as the change of one or more ciphers in a common arithmetical sum, in consequence of our discovering an error upon working it a second time. This determination, or motive, however, may be changed every hour, or even every minute; for the mind may take a new view of the subject: it may obtain clearer ideas from fresh sources; or other affections may be called into play than those which have hitherto produced an influence; and what before was decided to be a certain path to pleasure, may next be decided to be as certain a road to misery and ruin.

And so active is the judgment in asserting its control, that even where the mind is borne down by the most violent passions, it still strives, at times, to recover its authority, and is seldom quiet till it has succeeded. Let me offer a single example in elucidation of this assertion.

Behold the enamoured youth, who, after having struggled for years with an unebbing current of obstacles, finds himself, at length, in possession of the fair object of his heart's affection. Here, the reigning power must necessarily be the passion of love, and it would be somewhat cynical to look for any thing else. Ask him in what his happiness consists, and what are the motives that stimulate every action of his life, and he will at once point to his beloved bride, without whom, he will tell you, that all nature would be a blank; and, with whom, that a wilderness would be a paradise. Behold her next, by the stealthy and startling hand of death, snatched away from his embraces. What now is the condition of the mind? the new motives that distract it? and the conduct to which they give rise? Is it possible that an ember of happiness can remain to him now?—Yes, even here, in the rack of anguish, he has still his delight—a lonely and a melancholy one, I am compelled to grant, but he has his delight notwithstanding; and the mind is as much hurried away, and as violently, by the present impulse, which is to weep over her remains, as by the past, which was to devote himself to her wishes:—

He haunts the deep cathedral shade,
The green sward where his love is laid,
And hugs her urn, and o'er the tomb
Hangs, and enjoys the specter'd gloom.
And oft to thee he lifts his eye,
Mild express of the spangled sky!
And thanks thy dewy beams, that guide
His footsteps to his clay-cold bride,
And oft he asks the starry train
That circle round thy silver reign,
By which her parting spirit pass'd,
And where she stay'd her flight at last.
He asks—and thither would he go—
For what has nature now below?

Thus far the mind has unquestionably evinced little or no control; and I bring forward these descriptions as instances of its subjugation. But even here, in one of the severest trials with which mankind can be visited, the mind gradually finds the means of recovering its ascendancy; the passions, by degrees become tranquillized, and in their turn subdued; the heart softened, the judgment corrected and fortified, and the reason set at liberty for reflection. The pale sufferer perceives, at length, that happiness, to be genuine, must be neither violent nor transitory: that its foundation must be permanent, and its nature unalloyed. He yields himself to this train of contemplation; and the mind, now fully reinstated in its government, indulges a sober and rational grief, and arrives at a sober and rational conclusion. It determines that earth has no such happiness to offer him; it may perhaps lead him further, and prompt him to seek it in a sublimer source.

This description I have drawn from the natural passions of the human heart—passions that, in a greater or less degree, are common to all countries and ages; but there are passions of which uncultivated nature knows nothing, which are the baneful offspring of a morbid civilization and immoral habits, and which possess, if possible, a still more tyrannical control over the judgment than any that nature herself has implanted within it. Such is the passion for GAMBLING, which has often, even in the sobriety of our own climate, maddened the brain of men who, but for this, had been worthy members of society, and plunged them into the foulest vices, and at length, into the deadly gulf of suicide. One of the best pictures of the heart-rending despair of such a wretch, just before the perpetration of this horrible crime, is to be found in the description of Beverley in "*The Gamester*," who is thus painted to the life, in the inevitable ruin into which he was thrown after having staked the last resource and final hope of his wife and family on one unfortunate and fatal hazard:—

"When all was lost, he fixed his eyes upon the ground, and stood some time with folded arms, stupid and motionless; then, snatching his sword that hung against the wainscot, he sat him down, and with a look of fixed attention drew figures on the floor. At last, he started up; looked wild, and trembled; and, like a woman, seized with her sex's fits, laughed out aloud, while the tears trickled down his face. So he left the room."

Yet, even here, under the fell sway of this accursed incantation, we are not without examples of its being occasionally broken through, and its deadly fetters shaken off by the virtuous resolution of a mind determined to prove its independence, and to act according to the dictates of its better judgment. As an example of which, among many others, I may refer to the conduct of one of the first statesmen of our own country, and our own age;—a statesman, whose name will ever be dear to Britain, on various accounts, but chiefly, perhaps, since under his administration, she set the glorious example to the world of abolishing the slave-trade. In early life it is well known that Mr. Fox was irresistibly addicted to this intoxicating passion; and it is also equally known, that in his maturer life, he tore himself from the further prosecution of it, by a courageous determination from which he never departed.

It appears obvious, then, that the mind both can and ought to maintain a general mastery over all its faculties; and is able, at all times, except in extreme cases, to furnish itself with motives. And hence, though it is perfectly true that it cannot will, or, in other words, cannot choose or refuse without a motive, and to this extent is under a necessity, yet the origination or change of motives being vested in itself, it is equally true that it is so far free to will, as well as to act or perform what it wills.

If the distinction here offered had been properly attended to, we should, as I am inclined to think, have had fewer opponents in all ages, to the doctrine of the freedom of the mind, or of the will as it is commonly denominated. Among the chief of these opponents we may rank the Fatalists of ancient, and the Necessarians of modern times.

The general train of argument by which they have been led, and the ground of its adoption, are not essentially different. Motives, volitions, and actions, are supposed by both sects to be of the same nature, in respect to relative force and operation, as physical causes and effects; and consequently, the same catenation, or necessary dependence of one fact upon another, which marks the experienced train of events in the natural world, is conceived to be perpetually taking place in the moral: "All voluntary actions," as Mr. Hume observes, "being subjected to the same laws of necessity with the operations of matter, and there being a continued chain of necessary causes pre-ordained, and pre-determined, reaching from the original cause of all to every single volition of every human being."* Or, as another writer upon the same subject has expressed it,—"The course of events, both moral and physical, is fixed and immutable; and thoughts, volitions, and actions, proceed in one interrupted concatenation from the beginning to the end of time, agreeably to the laws originally established by the great Creator."

So that, under the same circumstances the same motives must be produced in the mind of every man, give rise to the same volitions, and be succeeded by the same actions; every one of these, to adopt the language of the Fatalists, being equally a link of that

Golden everlasting chain,
Whose strong embrace holds heaven, and earth, and main.

If it were not so, it is pretended that there could be no mutual dependence or confidence between man and man. No person, from the appearance of one action, as performed by his neighbour, could infer a second, or form any opinion of his character. And even the doctrine of divine prescience must be entirely relinquished; since, without such a necessary and consecutive connexion, it must be impossible for the Deity himself to foresee any future event, or to know it otherwise than as it occurs at the moment.

It was not my intention to have touched upon this controversy, but the principles upon which it hinges are so closely blended with the subject before us, that it is impossible altogether to elude it, though the remarks I propose to offer shall be as brief and compressed as I am able to make them.

In the first place, then, whatever be the necessary connexion between motives, volitions, and actions, it is by no means true that they are "subjected to the *same laws of necessity* with the operations of matter." Let me support this assertion by a reference to a few simple facts. A needle, or an iron ball, placed between two magnets of equal power, will fall to neither of them, but remain midway at rest for ever, suspended between equally contending attractions. Now, if the same laws of necessity control the moral as control the physical world, a similar moral cause must produce a similar moral effect: and the traveller who, by accident, after having lost himself in a forest, should meet with two roads running in opposite or different directions, and offering in every respect an equal attraction, must, like the needle or bullet, remain for ever at rest, because the motive to take one course is just equipoised by the motive to take the other. But can any man in his senses suppose he would remain there for ever, and so starve himself between equally contending attractions? Or rather, can any man suppose such a fact, provided the traveller himself, were in his senses? Yet Montaigne, in support of this hypothesis, has actually supposed such a fact, and has put forth the following whimsical or facetious example: "Where the mind," says he, "is at the same time equally influenced by two equal desires, it is certain it can never comply with either of them, because a consent and preference would evince a dissimilarity in their value. If a man should chance to be placed between a bottle of wine and a Westphalia ham, with an equal inclination to eat and to drink, there could, in this case, be no possible remedy; and by the law of necessity he must die either of hunger or thirst. The Stoics, therefore," continues he, "who were most rigidly attached to the doctrine of fatalism, when asked how the mind determines when two objects of equal desire are presented to it, or what is the reason, that out of a number of crown pieces it selects one rather than another, there being no motive to excite a preference, reply, that this action of the mind is extraordinary and irregular, and proceeds from an impulse equally irregular and fortuitous. But it would be better," continues Montaigne, "in my estimation, to maintain that no two objects can be presented to us so perfectly equal, but that some trifling difference may subsist, and some small superiority be discoverable either in the one or the other."

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* Essays: On Liberty and Necessity; vol. ii.

And no doubt it would be better to maintain such a position; but, who does not see that this is to give up the question? to renounce the point upon which we are at issue, and openly to confess that there does not exist in the moral world the same counterpoise of cause and cause that is to be perpetually met with in the natural.

Let us confine ourselves to one more example. A cannon-ball, discharged from the centre of a circle, and equally attracted to the north and to the east, will proceed towards neither point; but at an angle of 22½ degrees, or immediately between the two. But is there any one, unincumbered with a strait waistcoat, who can suppose that such a rule has any application to the motive powers of the mind? who can conceive, that a man starting at Blackfriar's Bridge, and having business so equally urgent at Highgate and Mile-end, that he is incapable of determining to which place he shall proceed first, would proceed to neither, but take a course between the two, and walk in a straight line to Hackney or Newington Green? Yet, unless he should thus act, not occasionally, or by accident, but uniformly, and at all times, there is not in the mind the same law of operation, the same sort of necessity, as in matter; but a something, whatever it may be, produced and designed to produce an irreconcilable distinction; and, in the correct language of the Epicurean philosophers, perpetually labouring to prevent the same blind force from vanquishing the one as it leads captive the other:

> Ne mens ipsa necessum
> Intestinum habeat cunctis in rebus agundis,
> ET DEVICTA QUASI, COGATUR FERRE, PATIQUE.*
>
> Lest the mind
> Bend to a stern necessity within,
> AND, LIKE A SLAVE, DETERMINE BUT BY FORCE.

But we are told, that unless the moral world were thus constituted, there could be no mutual confidence between man and man; no series of actions could be depended upon, and it would be impossible to distinguish between one character and another; or, in other words, how long the same individual would maintain the same character.

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* De Rer. Nat. ii. 289.

Now this kind of argument, if accurately examined, just as much invalidates the doctrine it is intended to support as the preceding. There is no one who pretends to place the same degree of confidence in the general course of human actions as in the experienced train of natural events. Even where the circumstances to reason from are equally definite, moral dependence is in all instances less certain than physical, and never amounts to more than a probability. The closest friendships may fail, the purest virtue become tarnished; and, in the words of Sophocles, which I must beg leave to put into our own language—

> The power of all things cease; e'en sacred oaths
> At times be broke, and the determined mind
> Forego its steady purpose.

Material causes, on the contrary, are regular in their operations, and uninterrupted in their effects. Nobody doubts that the sun will rise to morrow; that a cannon-ball will sink in water; or that if the lamps over our heads were to be extinguished, we should be in darkness. The power of Buonaparte, when in the zenith of his success, was absolute and almost unbounded, but did even this ensure steadiness of conduct? Quite the reverse. We behold the decrees of to-day overthrown by those of to-morrow, and, in the blind and overwhelming career of his ambition, his hosts of blood-hounds that have just plundered his enemies next sent against his friends; we behold every thing in nature, that is within his reach, tottering and out of joint; while every thing that is beyond and above him continues steadfast and unchangeable; the air is as vital as ever, the seasons as regular in their courses, and, to adopt the beautiful language of our poet laureate—

> The moon,
> Regardless of the stir of this low world,
> Holds on her heavenly way.

But we are farther told, that unless there be the same fixed and dependent chain established in the moral creation which unquestionably exists in the physical, the Deity himself could have no prescience or foreknowledge of human conduct. And so forcible has this argument appeared to some men, and men too, of acknowledged worth and piety, that in the dilemma into which they have felt themselves thrown, like the Brahmins of the East, they have utterly abandoned the doctrine of divine prescience in favour of that of moral liberty.

Shallow and impotent conclusion! Absurd admission of an hostility that has no existence! as though he who sees through infinite space, is incapable of seeing through the brief duration of time; or as though, like Theseus in the Cretan labyrinth, the great author of nature stands in need of a thread to guide him through the maze of his own creation, and depends upon every preceding event as a direction-post to that which follows. There are contingencies in the natural as well as in the moral world, though they are far less frequent because far less necessary. Miracles are of this description; they are direct and palpable deviations from the common laws of nature, the common routine of causes and effects; and he who denies that the Deity can know any thing of contingencies, in the one case, ought also to deny that he can know any thing of them in the other; for the necessary and consecutive chain of causation, upon which alone such philosophers found the attribute of prescience, is equally broken in both instances. But such philosophers have to deny still more than this, or they must abandon their principle altogether. They have equally to deny that the Deity can see or know any thing of such anomalies, even when present; for if he can only know events as successive and necessary links of preceding events, the tie being broken, on their appearance, and the anomalous events detached, he can have no more knowledge of them when gone by or present than when future. It may, perhaps, be thought, that when present and operating they pass before him. Pass before him! O puerile and miserable conception of the Divinity! All nature is equally before him, in every point of space, and every moment of eternity, and he who denies God to be every where, must deny him to be any where; unless he sees and knows every thing, he must see and know nothing. Miracles and moral contingencies, then, are as much provided for, and must be so, as the most common train of natural events. It is true, we know nothing of the arrangement by which they subsist, but they are and must be provided for nevertheless. It is here and here only we ought to rest—in an equal acknowledgment of human ignorance and divine perfection;—for it is, assuredly, not quite consistent either with the modesty of genuine philosophy, or the reverence of religious faith, to controvert a truth because we cannot account for it; or to pluck away attribute after attribute from the diadem of the Deity, out of mere compliment to the demand of a fanciful and empty hypothesis. I retreat from this subject, however, with pleasure. It is too perplexed and mysterious for popular discussion, and I am fearful of darkening it by illustration. I should not have touched upon it, but that I have been forced, by the regular progress of our own inquiries; and now turn, with a free and unfettered foot, to the study of the passions; their general nature and influence upon the human actions and language, which we shall enter upon in our next lecture.

LECTURE IX.

ON THE ORIGIN, CONNEXION, AND CHARACTER OF THE PASSIONS.

We have entered upon an inquiry, concerning the nature and operation of the various faculties that constitute the general furniture of the mind. These we have divided into three classes; the faculties of the understanding, the faculties of volition, and the passions or faculties of emotion. The commencement of the present series of lectures was devoted to an illustration of the first; the second we discussed in our preceding study; and we now advance to a brief analysis of the third.

In sailing over the sea of life, the passions are the gales that swell the canvass of the mental bark: they obstruct, or accelerate its course; and render the voyage favourable or full of danger, in proportion as they blow steadily from a proper point, or are adverse or tempestuous. Like the wind itself, they are an engine of high importance and mighty power. Without them we cannot proceed; but with them we may be shipwrecked and lost. Reined in, therefore, and attempered, they constitute, as I have already observed, our happiness; but let loose and at random, they distract and ruin us.

> How few, beneath auspicious planet born,
> With swelling sails make good the promised port,
> With all their wishes freighted. YOUNG.

Let it not be forgotten, however, that the passions are not distinct agents, but mere affections or emotions, mere states or conditions of the mind, excited by an almost infinite variety of external objects and events, or internal operations and feelings. And here, the first remark that will probably occur to us is, that, derived from sources thus numerous and diversified, they must themselves form a numerous and motley host. Some of them are simple, others complex; some peculiar to certain circumstances or individuals, others general, and embracing all countries and conditions; some possessing a natural tendency to promote what is good; and others, what is mischievous and evil; while many of them, again, though distinguished by separate names, only differ from other passions in degree; and hence, naturally merge into them upon a change in the scale.

It has often occurred to me, that if we were to follow up all the passions, multiplied and complicated as they are, to their radical sources, and to draw out their respective genealogies, we might easily reduce them to four—Desire, Aversion, Joy, and Sorrow. And as aversion and sorrow are only the opposites of desire and joy, and must necessarily flow from their existence in a state of things in which all we meet with is not to be desired or enjoyed, it is possible that desire and joy ought alone to be regarded as the proper parent stocks of all the rest. Let us examine them for a few minutes, under this system of simplification.

Perhaps the oldest, simplest, and most universal passion that stirs the mind of man, is DESIRE. So universal is it, that I may confidently ask, where is the created bosom—nay, where is the created being, without it? And Dryden is fully within the mark in asserting, that

> Desire's the vast extent of human mind.

AVERSION, which is its opposite, is less universal, less simple, and of later birth. It is less universal, for though there is no created being exempt from it, nor ought to be so upon certain points, it is more limited in its objects and operation. It is of later date, at least among mankind, for the infant desires before it dislikes; and hence there is as much physical truth as picturesque genius in the following exhortation of Akenside, to the lovers of taste and nature;—

> Through all the maze
> Of YOUNG DESIRE, with rival steps pursue
> The charm of beauty.

And it is less simple, as being the opposite of desire, and in a certain sense flowing from it, and connected with its existence; the whole of its empire being founded on objects and ideas that the elder passion of desire has rejected.

Now, the main streams that issue from DESIRE, running in different directions, and giving rise to multitudes of secondary streams, are the three following:—LOVE, HOPE, EMULATION. Examine them attentively, and you will find, that, different as they are from each other, they all possess the sperm and parentage of DESIRE, and possess it equally.

LOVE is not simple desire, but flows from it, and is so closely connected with it, that some shade of the latter passion is, in every instance, to be found in the former. The terms are hence, in some particular senses, and especially when employed loosely, used in all languages synonymously: whence EROS (Ἔρως) among the elegant Greeks, and CUPIDO among the Romans, was the god equally appointed to preside over both passions. It is from the latter tongue we obtain in our own language the word *cupidity*, which in like manner embraces both ideas. Spenser has made desire the offspring of love, rather than love the offspring of desire; but this is to invert the order of nature. The first instinctive passion discoverable in infant life, as I have already observed, is desire—a desire of satisfying the new-born sensation of hunger; and love—that is, love of the object that gratifies it, follows from the gratification itself; nor can we, through any period of life, love what in our own estimation is undesirable. In many cases, for there are innumerable shades belonging to both, love may be regarded as the same passion as desire, but with an increase of intensity; as hatred, which is its opposite, is the same passion as aversion, but with a parallel advance in the scale. There are, however, various marks of difference; and I may observe, that while desire is never without a less or greater degree of uneasiness, love, though it is sometimes accompanied with the same feeling, is occasionally free from it, and always so when perfectly genuine.

Before we proceed to the two other main branches which radiate from DESIRE, let us follow up the subsidiary streams into which the passion of LOVE ramifies. These run in two opposite directions, according as they possess a virtuous or a vicious tendency; and in each direction they are extremely prolific, and offer to us a numerous progeny. Thus, on the one hand, we behold the passion or feeling of love giving birth to charity, benevolence, philanthropy, pity, mercy, fellow-feeling, which the Latins called compassion, and the Greeks sympathy; generosity, friendship, and ardour. They form a chaste and a happy group, are full of social affection, and are hence often called, after the name of the eldest sister, the CHARITIES of life or of the heart.

> Mercy, and Truth, and hospitable Care,
> And kind connubial Tenderness, are there;
> And Piety, with wishes placed above,
> And sweetest Sympathy, and boundless Love.
>
> GOLDSMITH, *altered.*

On the other hand, we behold issuing from the same source a variety of restless and turbulent affections, which, from their characteristic violence, contribute equally, perhaps, to the unhappiness of those who possess them, and to the world on which they are exercised. To this tribe belong avarice, or the love of gain; ambition, or the love of power; pride and vanity, or the love of pomp, splendour, and ostentation; selfishness, or the love of the person, in common language, self-love: though the whole of these being of a selfish character, this latter term might, with as much propriety, apply to every one of them, as that of charity or the love of others to each of the preceding division.

Most of these are admirably described or allegorized by Spenser, in his Fairie Queene, which will be found to afford a most powerful illustration of the general hints here offered. I would readily bring instances in proof of this remark if our time would allow: as a single example of the force of his imagination, let me especially direct your attention to his entire delineation of avarice or mammon, and particularly the following picturesque representation of his dwelling—

> Both roofe and floore, and walls, were all of gold,
> But overgrowne with dust and old decay,
> And hid in darkness, that none could behold
> The hew thereof: for vew of cherefull day
> Did never in that house itselfe display,
> But a faint shadow of uncertain light:
> Such as a lamp, whose life does fade away;
> Or as the moone, cloathed with clowdy night,
> Does shew to him that walkes in feare and sad affright.*

Hope I have enumerated as the second main stream that emanates from the passion of DESIRE. Try the world, examine your own hearts, and you will agree with me that this is its source. Hope must spring from desire, and cannot exist without it: as it rises in the scale, it becomes trust or confidence, and confidence, according to the alliance it forms with other feelings or affections, gives birth to two very different families. United to a vigorous judgment and an ardent imagination, it produces courage, magnanimity, patience, intrepidity, enterprise; combined with vanity or self-love, the complex and mischievous brood is self-opinion, impudence, audacity, and conceit.

Hope, however, is not produced singly. It is a twin passion, and its congenital sister is Fear. This has not been sufficiently attended to by pathognomists; but examine the general tenour and accompaniment of the passions as they rise in your hearts, and you will find the present statement correct. Hope and fear spring equally from desire—the hope of gaining the desired object, and the fear of losing it. They run the same race, though with varying degrees of strength, and terminate their joint career in the antagonist extreme points of fruition or despair; the powers of hope growing gradually more intense as it approaches the former goal, and those of fear as it approaches the latter.

I have said that at these boundaries they terminate their respective career; but fear does not always cease with fruition. Uncertainty and change are so strongly written on all earthly enjoyments, that even in the firmest possession we have still some fear of losing them; so that we can seldom say, "what a man hath, why doth he yet fear for?" though nothing is more pertinent than the opposite inquiry, "what a man hath, why doth he yet hope for?" Fruition without fear is reserved for, and will be, the great prerogative of a higher state of being.

Fear, however, like hope, in its progress through life, forms other alliances than that which springs during its infancy. Combined with a sense of failure or imperfection in our own powers, it takes a right direction, and produces caution, timidity, bashfulness, diffidence, respect, and complaisance: united to friendship, love, or complacency, it engenders gratitude, devotion, reverence, veneration, and awe, which are only different degrees of the same feeling: and hence the term FEAR, in the sense we are now taking of it, becomes an apt and beautiful type of every religious affection; of desire; as love, gratitude, zeal, devotion, and awe; for we have just traced it as branching up in this direct line of descent.

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* B. ii. cant. vii. xxix.

The connexions of fear, moreover, like those of hope, are of a bad as well as of a good character: united to a judgment that measures its powers amiss, and entertains too mean an opinion of them, it degenerates into irresolution, doubt, cowardice, and pusillanimity: combined with a restless and irritable imagination, it begets suspicion, jealousy, dread, terror; and terror, when combined with hate, gives birth to the passion of horror. It is in this last character, as connected with the fancy or imagination, that the term FEAR is for the most part employed by the dramatists; and it is to this that Collins has entirely confined himself in his celebrated ode upon the subject.

Thou to whom the world unknown,
With all its shadowy shapes, is shown;
Who seest, appall'd, th' unreal scene
When fancy lifts the veil between,—
Ah, Fear! ah, frantic FEAR!
I see, I see thee near.
I know thy hurried step, thy haggard eye:
Like thee I start, like thee disorder'd fly.

The third main passion which issues from the common stock of DESIRE I have said is EMULATION. This, when properly attempered, and connected with what have already appeared to be the social affections, is one of the noblest and most valuable emotions that actuates the human heart. It commences early, and often accompanies us to the closing scene of life. It inspirits the play of the infant, the task of the schoolboy, and the busy career of the man. It gives health and vigour to the first, applause and distinction to the second, and riches and honour to the third. But emulation, instead of being connected with the social, is often connected with the selfish affections; and in this case it degenerates into rivalry, an ungenerous strife to equal or surpass a competitor where there is a chance of success; or into envy, which is a mixture of emulation and hatred, where there is not.

The antagonist passion to DESIRE is AVERSION, which has also, like desire, different degrees of intensity, and a family of diversified characters, though in neither respect so numerous or complicated as the former.

It not unfrequently unites itself to pride, and produces as its progeny the jaundiced family of scorn, contempt, and disdain; the last of which is thus described by Spenser:

His looks were dreadful, and his fiery eyes,
Like two great beacons, glared far and wide,
Glancing askew, as if his enemies
He scorn'd in his overweening pride;
And stalking stately, like a crane did stride
At every step upon the tip-toes high;
And all the way he went, on every side
He gazed about, and stared horribly,
As if he, with his looks, all men would terrify.

Aversion, combined with a quick sense of being wronged, whether real or imaginary, becomes anger; anger, when violent or ungovernable, is denominated rage or fury; and, when stimulated by a determination to retaliate, it assumes the name and shape of revenge. Hatred is only aversion advanced to a higher degree in the scale; and hatred, colleagued with a fixed and clandestine desire to injure, degenerates into malice; the foulest, most despicable, and most devilish of all the passions that can harass an intelligent being, and the most opposite to the character of the Divinity; for God is love, and the stamp of benevolence is printed on every part of creation.

> De secretes beautes quel amas innombrable!
> Plus l'Auteur s'est cache, plus il est admirable!*
> What boundless beauties round us are display'd!
> How shines the Godhead mid the darkest shade!

Such, then, are the numerous and diversified families that issue directly or collaterally from the passion of desire, or of aversion as its opposite. I stated this passion to be almost universal in its range, and I submit to you whether this statement has not been verified.

The two other radical sources into which we are to resolve the remaining passions of the heart are JOY and SORROW: of equal weight and moment in the scale of life, but less numerous and complicated in their offspring; and which will therefore detain us but for a few minutes.

Joy, when pure and genuine, is a sweet and vivacious affection. It is the test and index of happiness or pleasure Its influence, like that of gravitation, extends to remote objects; and it lightens the severest labours by its foretaste. It is the breath, the nectar of heaven, and the high reward which stimulates us to a performance of our duty while on earth.

Joy, like several of the preceding passions, has different names assigned to it, in its different stages of ascent; at its lowest point, it is ease, content or tranquillity; at a certain elevation, it is called delight or gladness; somewhat farther in the scale, exultation; beyond this, rapture or transport,—for the terms, as applied to this passion, are synonymous; and advanced far higher, it is ecstasy—joy so overwhelming as to take away the senses, and prevent all power of utterance. Among the Greeks, however, the term ECSTASY was used in a more general sense, and applied to any overwhelming affection, whether of joy or sorrow; and Shakspeare, who has often carried it farther than the Greeks, occasionally makes it a feature of madness or mental distraction, which is not passion but disease. The following from his Hamlet is an instance of this signification.

> Now see that noble and most sovereign reason,
> Like sweet bells jangled, out of tune and harsh;
> That unmatched form and feature of blown youth
> Blasted with ECSTASY.

Combined with activity, joy produces the light-hearted family of cheerfulness, gayety, mirth, frolic, and jocularity; the best and most lively picture of which that the world has ever seen, is given by Milton in his Allegro, mirth being here placed at the head of the whole.

> Haste thee, nymph, and bring with thee
> Jest and youthful Jollity,
> Quips, and cranks, and wanton wiles,
> Nods, and becks, and wreathed smiles,
> Such as hang on Hebe's cheek,
> And love to live in dimple sleek;
> Sport, that wrinkled care derides,
> And Laughter holding both his sides.

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* Racine le fils, Poeme de la Religion.

Come, and trip it as you go
On the light fantastic toe.
And in thy right hand lead with thee
The mountain nymph, sweet Liberty.

Possessing features in many respects similar, we meet with another lively tribe, which are equally the offspring of joy, but of joy in alliance with an ardent imagination. These are sentimentalism, characterized by romantic views or ideas of real life; chivalry, which is the sentimentalism of gallantry, caparisoned for action, and impatient to enter the burning list,

Where throngs of knights and barons bold
In weeds of peace high triumphs hold,
With stores of ladies, whose bright eyes
Rain influence, and judge the prize.

This extravagant passion had its use in the feudal times; but it has for ages become antiquated, and in modern warfare has certainly too much gone out of fashion.

To the same tribe belongs enthusiasm, the joyous or ecstatic devotion of a high-wrought fancy to some particular cause or party, the chief of which are religion and patriotism: and under the influence of which, the body is wound up to a display of almost preternatural exploits, and an endurance of almost miraculous privations and labour.

The sprightly passion of joy gives birth also to a third tribe, in consequence of its union with novelty. It is a listening and attentive group, and consists of admiration, surprise, wonder, and astonishment; upon which I need not enlarge, except to remark that the word astonishment is, at times, made use of to express a very different feeling, produced by novelty and terror; and which is more accurately distinguished by the name of amazement. These mixed passions, however, are very apt to run into each other, as I shall have occasion to notice more at large in a subsequent study; and perhaps the most exquisite feeling a man can possess of the purely mental kind, is derived from a contemplation of scenery, or a perusal of history, where every thing around him is grand, majestic, and marvellous, and the terrible keeps an equal, or rather nearly an equal pace with the delightful.

The opposite of JOY is SORROW—a fruitful mother of hideous and unwelcome children; fruitful I mean on earth, but shut out with a wall of adamant from the purer regions of the skies.

Sorrow is as much distinguished by different names as any of the preceding affections, according to the height it reaches in the general scale of evil. And hence, at one point, it is sadness; at another, wo or misery; at a third, anguish; and its extreme verge, distraction or despair.

Connected with a sense of something lost, or beyond our reach, it gives rise to regret and grief: and when in union with a feeling of guilt, it becomes remorse and repentance.

Its two bosom companions, however, are fear and fancy. When allied to the former alone, it produces the haggard progeny of care, anxiety, vexation, and fretfulness; the first of which is thus admirably described by Hawkesworth, in his ingenious but melancholy piece, entitled Life, an Ode; in which care is directly stated, as in the present case, to be a mixed breed of wo or sorrow and fear.

Who art thou, with anxious mien
Stealing o'er the shifting scene?
Eyes with tedious vigils red,
Sighs by doubts and wishes bred;
Cautious step and glancing leer,
Speak thy woes, and speak thy fear.

When sorrow associates herself with both fear and fancy, she then produces the demon brood of dejection, gloom, vapours, moroseness, heaviness, and melancholy; all of them begotten, like the last,

In Stygian cave forlorn,
'Mong horrid shapes, and shrieks, and sights unholy.

Such is the origin of melancholy, as given by Milton, in his Allegro, or ode to Mirth; but in his Penseroso, or ode to Melancholy herself, he derives her from a purer source, and dresses her in the pensive character of a religious recluse. The picture shows a fine imagination; but is, perhaps, less true to nature than the preceding.

Come, pensive nun, devout and pure,
Sober, steadfast, and demure,
All in a robe of darkest grain,
Flowing with majestic train,
And sable stole of cypress lawn
Over thy decent shoulders drawn—
Come, but keep thy wonted state,
With even step, and musing gait,
And looks commercing with the skies,
Thy rapt soul sitting in thine eyes.
There, held in holy passion, still
Forget thyself to marble, till
With a sad, leaden, downward cast,
Thou fix them on the earth at last.

Despair or distraction brings up the rear of the miserable and tumultuous group before us. This passion has generally been contemplated as a mingled emotion; but it is perhaps far less so than most of the rest. It is a concentration of pure, unmitigated horror, equally void of hope, fear, and all moral feeling—an awful type of the torments of the lower world. The sensorial power is hurried forward towards a single outlet, and with a rushing violence that threatens its instantaneous exhaustion from the entire frame, like the discharge of electricity accumulated in a Leyden jar when touched by a brass rod. The eye is fixed; the limbs tremble; upon the countenance hangs a wild and unutterable sullenness. The harrowed and distracted soul shrinks at nothing, and is attracted by nothing; the deepest danger and the tenderest ties have equally lost their command over it.

Despair is, hence, the most selfish of all the passions. In its overwhelming agony, and its pressing desire of gloom and solitude, it approaches to what is ordinarily called HEART-ACHE; but, generally speaking, the emotion is far more contracted and personal, and the action far more precipitous and daring. Despair, as it commonly shows itself, is either hopelessness from mortified pride, blasted expectations, or a sense of personal ruin.

The gamester, who cares for no one but himself, may rage with all the horror of despair; but the heart-ache belongs chiefly to the man of a warmer and more generous bosom, stung to the quick by a wound he least expected, or borne down, not by the loss of fortune, but of a dear friend or relation, in whom he had concentrated all his hopes. The well-known picture of Beverley is drawn by the hand of a master, and he is represented as maddened by the thought of the deep distress into which his last hazard had plunged his wife and family; but if his selfish love of gaming had not triumphed over his relative love for those he had thus ruined, he would not have been involved in any such reverse of fortune; nor, without the same selfishness, would he further have added to their blow by a deed that was sure to withdraw him for ever from all share in their misery, and overwhelm them with an accumulated shock. While Beverley was in despair, it was his wife who was broken-hearted.*

The picture which Spenser has drawn of despair, as seated in his own wretched cave, has been praised by every one from the time of Sir Philip Sidney; but it has always appeared to me that his description of Sir Trevisan, who was fortunate enough to escape from the enchantment of this demon-power, is still more forcibly drawn in the passage where, on the commencement of his flight, he is represented as accidentally meeting with the Red Cross Knight:

> He answered nought at all; but adding new
> Feare to his first amazement, staring wyde
> With stony eyes, and hartless, hollow vew,
> Astonisht stood, as one that had aspyde
> Infernall furies with their chaines untyde.
> Him yett againe, and yett againe, bespake
> The gentle Knight, who nought to him replyde;
> But, trembling every ioynt, did inly quake,
> And foltring tongue at last these words seem'd forth to shake—
>
> "For God's dear love, sir Knight, doe me not stay;
> For loe! he comes, he comes fast after mee!"
> Eft looking back, would faine have runne away;
> But he him forst to stay, and tellen free
> The secrete cause of his perplexitie.†

Such, as it appears to me, are the chief passions or faculties of emotion discoverable in the human mind. I submit, however, the present analysis and classification of them with some degree of diffidence; for, as far as I am aware, it is the first attempt of the kind that has ever been ventured upon; and, like other first attempts, it may perhaps be open to the charge of considerable imperfections and errors. Be this, however, as it may, it at least offers us a new key to the mind's complicated construction in one branch of its study, simplifies its machinery, and perhaps unfolds a few springs which have never hitherto been sufficiently brought into public view.

I have said that the use of the passions is to furnish us with happiness, as that of the intellectual faculties is with knowledge, and that of the faculties of volition with freedom. But from the survey thus far taken, it must be obvious to every one, that the passions furnish us with misery as well as with happiness. And it may, perhaps, become a question with many, whether the harvest of the former be not more abundant than that of the latter. We cannot, therefore, close this subject better than by briefly inquiring whether the passions produce happiness at all? Whether, allowing the affirmative, they produce more happiness than misery, and whether the present constitution of things would be improved if those that occasionally produce misery were to be banished from the list?

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* Study of Medicine, vol. iv. p. 133. edit. 2d. 1825.
† Faerie Queene, b. i. c. ix. 24, 25.

Supposing, by a decree of the Creator, all the mental passions were to be eradicated from the human frame, and nothing were to remain to it but a sense of corporeal pain and pleasure,—what would be the consequence under the present state of things, with this single alteration? Man would cease to be a social being; the sweet ties of domestic life would be cut asunder; the pleasures of friendship, the luxury of doing good, the fine feeling of sympathy, the sublimity of devotion, would be swept away in a moment. The world would become an Asphaltitis, a dead and stagnant sea, with a smooth unruffled calm, more hideous than the roughest tempest. No breeze of hope or fear, of desire or emulation, of love or gayety, would play over it: the harmony of the seasons would be lost upon us, and the magnificence of the creation become a blank. The wants and gratifications of the body might instigate us, perhaps, to till the soil; to engage in commerce and mechanical pursuits, and to provide a generation to succeed us. And if literature should exist at all, a few cold and calculating philosophers might spin out their dull fancies upon abstract speculations, and a few Lethean poets write odes upon indifference; but all would be selfish and solitary. The master-tie would be snapped; the spiritus rector would be evaporated, and every man would be a stranger to every man.

To a state of being thus torpid and monotonous, let us now grant the pleasurable passions, and withhold those that accompany or indicate uneasiness. Now, uneasiness, as I have already observed, is, in some degree or other, an essential attendant upon desire, hope, and emulation: and hence these passions must as necessarily be excluded here as under the former scheme. For a similar reason, we must allow neither generosity, nor gratitude, nor compassion; for put away all sorrow and aversion, all mental pain and uneasiness, and such affections could have no scope for their exertion: they must necessarily have no existence.

But still the world would be thronged with a gay and lively troop of passions; love and transport, mirth and jollity, would revel with an uninterrupted career:—not a cloud would obstruct the laughing sunshine; and man would drink his full from the sea of pleasure, and intoxicate himself without restraint.

But how long would this scene of ecstasy continue? Under the present constitution of nature, not a twelvemonth. In less than a year, the world, in respect to its inhabitants, would cease to exist: worn out by indulgence, and destroyed for want of those very uneasinesses, those pains and sorrows, those aversions and hatreds, which, when skilfully intermixed and directed, like wholesome but unpalatable medicines, chiefly contribute to its moral health; and form the best barriers against that misery and ruin, which, when superficially contemplated, they seem expressly intended to produce; but which man must be obnoxious to in a state of imperfection and trial, and would be infinitely more so but for their presence and operation.

The sum of the inquiry, then, is, that all the passions have their use,—that they all contribute to the general good of mankind;—and that it is the abuse of them, the allowing them to run wild and unpruned in their career, and not the existence of any of them, that is to be lamented. While there are things that ought to be hated, and deeds that ought to be bewailed, aversion and grief are as necessary to the mind as desire and joy. It is the duty of the judgment to direct and to moderate them; to discipline them into obedience, and to attune them to harmony. The great object of moral education is to call forth, instruct, and fortify the judgment upon this important science; to let it feel its own power, and accustom it to wield the sceptre intrusted to it with dexterity and steadiness. Where this is accomplished, the violent passions can never show themselves—they can have no real existence; for we have already produced evidence that they are nothing more than the simpler affections, discordantly associated, or raised to an improper pitch. Where this is accomplished, the sea of life will, for the most part, be tranquil and sober,—not from indifference or the want of active powers, but from their nice balance and concord; and if, in the prosecution of the voyage, the breeze should be fresh, it will be still friendly, and quicken our course to the desired haven. Finally, wherever this is accomplished, man appears in his true dignity—he has achieved the great point for which he was created, and visions of unfading glory swell before him, as the forthcoming reward of his present triumph.

LECTURE X.

ON THE LEADING CHARACTERS AND PASSIONS OF SAVAGE AND CIVILIZED LIFE.

In the preceding lecture but one I stated, as may, perhaps, be remembered by many of the audience before me, that, of the numerous and complicated faculties which form the nice mechanism of the human mind, sometimes one, sometimes another, and sometimes several in conjunction, appear peculiarly active and prominent, and acquire a mastery over the rest; and that such effect is, in different instances, the result of different causes, as peculiarity of temperament, peculiarity of climate, or peculiarity of local or national habits and associations. Let us pursue this subject, and make it a groundwork for the present lecture.

All violent passions are evil, or in other words, produce, or tend to produce, unhappiness: for evil and unhappiness are only commutable terms. There is no proposition in morals that admits of clearer proof. Some violent passions are evil intrinsically; others as extremes of those that are good; and all of them as refractory and hostile to the legitimate control of the understanding. For happiness, as we had lately occasion to prove, is a state of discipline; and is only to be found, in any considerable degree of purity and permanency (without which qualities it is unworthy of the name,) in a regulated and harmonious mind; where reason is the charioteer, and reins, and guides, and moderates the mental coursers in the great journey of life, with a firm and masterly hand.

It may, hence, be supposed, that the greatest degree of violence and unhappiness to be met with any where, is among savages; since, unquestionably, it is here that the traces of discipline are most feeble and obscure. And such, in fact, is the concurrent opinion of moralists and civilians. But it is an opinion which should be given with some degree of hesitation. It is true so far as the simpler passions, and especially those of the selfish class, are concerned,—passions which are more or less common to all countries and conditions; but civil life has passions peculiar to itself, and passions, too, of peculiar force and obstinacy, that

> Grow with its growth, and strengthen with its strength,

which no system of internal discipline seems at all times capable of moderating; which, in too many instances, we behold defying, with equal contumacy, all the laws of religion and morality; and, consequently, introducing into the world pains and penalties, mischiefs and miseries, which the tribes of barbarous and uncultivated nature, amidst all their evils, know nothing of.

To a certain extent, it is, however, probable, that the common opinion is correct, and that the greatest portion of violence and wretchedness is to be met with in savage life.

Now what are the passions that are chiefly brought into action, in this low and lamentable state of existence? Let us take a brief survey of them,—it may prove an interesting inquiry,—and examine the changes they undergo, and the new affections they give rise to, as man emerges from chaos to order, from the gloom of ignorance to the light of civilization, morality, and science.

One common character runs through savages of every kind. The empire of the heart is divided between two rival deities or rather demons—Selfishness and Terror. The chief ministers of the first are lust, hatred, and revenge; the chief ministers of the second are cruelty, credulity, and superstition. Look through the world, and you will find this description apply to barbarians of every age and country.

It is equally the history of Europeans and Africans; of the Pelasgi, who were the progenitors of the Greeks, and of the Celts and Scythians, the successive progenitors of the English. All the discoveries of modern circumnavigators confirm the assertion; and though the captivating names of Friendly and Society Islands have been given to two distinct groups in the vast bosom of the Pacific Ocean, and the inhabitants in several of them have made some progress in the first rudiments of civilization and government, there is not a people or a tribe to be met with, who are yet in a savage state, that are not still slaves to these debasing and tyrannical passions. The gentleness of courtship, or rather the first proof of affection, among the savages of New South Wales, consists in watching the beloved fair one of another tribe to her retirement, and then knocking her down with repeated blows of a club or wooden sword. After which impressive and elegant embrace, the matrimonial victim is dragged, streaming in her blood, to the lover's party, and obliged to acknowledge herself his wife. Cannibalism, in times of war, is still common to several of the islands; human immolation to most of them. It was at the bloody shrine of revenge, that Captain Cook fell a sacrifice in Owhyhee, one of the best-informed and most disciplined of all the islands; nor has any one, perhaps, who ever read the interesting history of Prince Lee Boo, forgotten the delight he manifested at St. Helen's on discovering a bed of groundsel, which he immediately converted to an article of food. All of them believe in magic—are the dupes of priestcraft and witchcraft—and in carving images of their deities, seem to think they can never represent them under figures sufficiently terrific and disgusting.

The simple but violent passions, then, common to mankind in savage life, are selfishness, lust, hatred, revenge, terror, cruelty, credulity, and superstition. These are differently modified, as well as combined with other passions, according to the force of collateral circumstances, as the dulness or vivacity of the intellectual faculties, the warmth or frigidity of the climate, the tameness or picturesque grandeur of the scenery, and the political constitution and habits of the people. Let us see how far this remark is supported by history.

From the cap or caf of the Caucasus descended those streams of adventurers that under the names of Getes, Goths, Scythians, and Scandinavians, over-run all the north of Europe, and progressively spread themselves from the Caspian Sea to the Thames. Born in the midst of snows, brought up in the midst of perils, and stretching their barren track from lake to lake, and from mountain to mountain, through the wildest, the boldest, the sublimest, and most fearful line of country that indents the face of the old world, they caught the gloomy grandeur that surrounded them; exchanged the love of women for the love of war; and carried fierceness and terror into the whole of their political institutions, their sullen ritual, and their mythology. They neither gave nor would consent to receive quarter; their highest honour being to fall in battle, and their deepest disgrace to sink into the grave by a natural death. They had their heaven, but it was only for heroes; and they denominated it Valhalla, or the hall of slaughter. They had also their hell, but it was only for those who died at home, and who, as they taught, were immediately conveyed to it, and tormented for ever, for their cowardice, with hunger, thirst, and misery of every kind. This audacious contempt of death, and burning desire to enter the hall of their ferocious gods, is correctly described by Lucan, who calls it a happy error—*felices errore suo.*

We here meet with all the passions I have enumerated as characteristic of savage life, but modified and peculiarly directed by local circumstances, which at the same time give birth to other passions equally fierce and violent.

Nerved by nature with a firm, robust constitution, and nursed in the midst of cliffs and cataracts, and torrents and tempests, they drank in courage and independence with every breath of air; their only delight was the gloomy one of hunting out difficulties and dangers; their only lust that of battle, and conquest; and their only fear that of being thought cowards on earth, and being shut out from the hall of slaughter in heaven. To adopt once more the language of Lucan, and follow up his correct description, which, nevertheless, before a mixed audience I must endeavour to give in our own tongue,

In error bless'd, beneath the polar star,
The worst of fears, the fear of death they dare;
Gasping for dangers, prodigal of pain,
Spendthrifts of life, that must return again.*

The natural passions of cruelty, hatred, and revenge seem to have remained untouched, and the whole character of the heart concurred in giving a terrible enthusiasm to their superstition. Patriotism they had none, for they had no country; and they only so far sacrificed their personal liberty, and concentrated themselves into tribes and clans, with leaders of limited authority at their head, as they found best calculated to give success to their lawless enterprises. And hence the origin of the feudal system, and the first rude efforts towards a basis of government and civilization in northern Europe.

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* Certe populi, quos despicit Arctus
Felices errore suo, quos ille timorum
Maximus haud urget lethi metus. Inde ruendi
In ferrum mens prona vivis, animæque capaces
Mortis; et ignavum rediture parcere vitæ
Phras. Lib. i. 458.

Let us contrast this picture with one of a different kind.

Seated in an early period of the world in the vicinity of these ferocious mountaineers, but at the southern foot of the Caucasus, instead of at its summit, we behold another set of barbarians, who progressively spread themselves into the softer regions of the south and west, under the names of Gomerians or Cymerians, and Celts. Their patronymic appellation sufficiently proves them to have been the sons of Gomer, and gives them a near connexion with the tribes we have just noticed. The country which formed their cradle was the finest part of Asia Minor, a country that has been regarded in all ages as the garden of the world. Soft tepid airs; a rich productive soil, that scarcely demanded cultivation; plains and sloping hills extending in every direction, and covered with fattening verdure; fountains interspersed and meandering rivers; banks blossoming with the choicest flowers, and suffused with the sweetest odours; the refreshing foliage of deep umbrageous woods; and over all the blue and cloudless canopy of the skies, diffusing light and laughter and benevolence, seemed labouring with happy concert to subjugate the rugged feelings of the savage heart, and attune it to harmony and peace. Nor was the magic force exerted in vain. The agreeable ideas hereby excited, prompted them, in their migrations, to seek, as far as they were able, for regions of a similar character; and the growing impulse of internal pleasure thus derived from external beauty gave a new direction to their mental powers. Selfish lust softened gradually into social love; the activity of a sportive fancy subdued the gloomy dictates of cruelty and revenge; the Gorgon form of fear gave place to the young radiance of hope; and superstition dropped her circlet of snakes, and half listened to the soothing song of reason and of truth.

In proof of this, it is only necessary to mention that they spread themselves from the head-spring of the Danube or Ister, as it was formerly called, to the mouth of the Tagus, and peopled in their progress Phrygia, so celebrated for its dithyrambic music and vigorous dance; the Troad, or country of Troy, ages ago

> Married to immortal verse:

Thrace, of scarcely less distinction than Troy; Hungary, the greater part of Germany, Gaul, Italy, Spain, and the British islands; sometimes confining themselves to small independent tribes, and sometimes, as in the warmer regions more especially, sinking conjointly into subjugation, under one ambitious and powerful chieftain. Different local circumstances diversified their general character; but for the most part we find them equally courteous and courageous, faithful to their engagements, hospitable to strangers, full of patriotism, loyalty, and domestic virtue; and let me add, it is to the quarter I am now speaking of that the Greeks were indebted not only for their Phrygian music, which formed their most enthusiastic and maddening movements, as I have just observed, but also for their Lydian, which formed its opposite, and was equally adapted to quell the cares and fury of the breast, and melt it into feelings of tenderness and affection. It is under this description Dryden speaks of it in his Ode to Alexander's Feast.

> Softly sweet in Lydian measures
> Soon he soothed his soul to pleasures.

And thus a greater than Dryden, in his well-known poem, entitled l'Allegro—

> And ever against eating cares
> Lap me in soft Lydian airs;
> In notes with many a winding bout
> Of linked sweetness long drawn out;
> With wanton heed, and giddy cunning,
> The melting voice through mazes running,
> Untwisting all the chains that tie
> The hidden soul of harmony.

Such, in most parts of the world, has been the effect of climate and surrounding scenery. But there is another cause, and a still more powerful one, that ought not to be admitted in the consideration of national character; and that is the government and habits of a people.

These may, in the first instance, be produced by accident; they may be the result of the cause already adverted to; but, when once formed and established, they lay a much firmer basis for public feeling and conduct than can be derived from any physical impulse whatever.

Persia had at one time as much reason as Macedonia to boast of her military hardihood and heroism; and, under the guidance of Cyrus, is well known to have overrun all Egypt and Asia Minor, taken Babylon, and destroyed the Assyrian empire. But her government at that time was most excellent; her code of laws full of wisdom; her administration of justice exemplary; and her morals the simplest and most correct in the Pagan world. Her youth, from the age of seven to that of seventeen, were allowed no other food than bread and cresses, and no other drink than water. They were all educated at public schools, provided by the state, and superintended by masters of the highest character for sobriety and science; who were enjoined by the constitution to use every means of inspiring them with a love of virtue for its own sake, and an equal abhorrence of vice. With the exception of the Macedonians, the Persians are the only people who enacted a law against ingratitude, punishing with a brand on the forehead every one who was convicted of so heinous a crime; a regulation which, I shrewdly suspect, if carried into execution in the present day, would wofully disfigure the faces of great multitudes of our contemporaries. The ear of the prince, moreover, was open to the advice of every one, but with this salutary limitation, to prevent the royal presence from being pestered with political busy-bodies: the adviser in proposing his opinion was placed upon an ingot of gold; if his counsel were found useful, the ingot was his reward; if trifling, or of no value, his reward was a public whipping.

So long as this system of simplicity and political jurisprudence continued, the Persians were the most powerful people in the world; but the temptations of a warm luxurious climate, and the influx of enormous wealth, from the conquest of surrounding countries, threw them gradually off their guard; their discipline became relaxed, their laws slighted, their manners changed; and the nation which was able to conquer Phrygia, Lydia, Egypt, and the proud empire of Assyria, not two centuries afterwards, fell prostrate before an army of little more than thirty thousand Greeks, under the banners of Alexander the Great.

If we turn our attention to the Greeks who triumphed on this proud occasion, their whole history will furnish us with a repetition of the same lesson. The mildness of their climate, the luxuriance of their soil, the picturesque beauty of their country, attuned all the rougher passions to harmony, and gave birth to an equal mixture of the gentler and the sublimer virtues. Composed of a variety of small separate states, united by a confederate tie, they felt a generous rivalry to surpass each other in whatever could contribute to enlarge or adorn the human understanding. And hence, while the well-balanced liberty they possessed inspirited them to defend it against every foreign aggression, in philosophy and ethics, in poetry and oratory, in music and painting, in sculpture and architecture, they became models of excellence for all other countries, and for all future ages. They too had their superstitions and their mythology; but the genius that pervaded every thing else pervaded these. A few grossnesses, indeed, which it is wonderful they should ever have allowed, deformed the whole machinery; but every thing besides, though wholly fictitious and ideal, was uniformly elegant, and for the most part instructive. Every grove, and stream, and mountain, was, in their opinion, instinct with some present deity, and under his immediate protection; and while the sacred heights of Olympus, the bright residence of their gods, was peopled, not with savage heroes and bloody banquets, as among the Scandinavians, but with the divinities of wit, and wisdom, and beauty—with the Loves, the Graces, and the laughing Hours, and the sister train of Music and Poetry.

Such was Greece: but what is she now? Her climate and bewitching scenery are the same; but her spirit and constitution are no more.—What, then, is she now? or rather what was she till of late? for the spirit of past ages has again in some measure revived in several parts of her. A few of her islands are under British protection; and a few others are struggling to throw off the yoke that has for ages equally subjugated them in body and in mind. But with the exception of these insular and more fortunate spots—NANTES IN GURGITE VASTO—what is she now? The eye sickens at the sight, and the tongue falters while it tells the change. A land of slaves and of barbarous usurpers; where the scourge of the cold Ottoman flays at his will the descendants of those who fell at Thermopylæ, and triumphed at the Granicus—while the tame victims that still submit to it, prove themselves well worthy of the fate that has befallen them:—

In all, save form alone, how changed!—and who,
That marks the fire still sparkling in each eye,
Who but would deem their bosom burn'd anew
With thy unquenched beam, lost Liberty!
And many dream withal the hour is nigh,
That gives them back their father's heritage;
For foreign arms and aid they fondly sigh,
Nor solely dare encounter hostile rage,
Or tear their name defiled from Slavery's mournful page.

Hereditary bondsmen! know ye not,
Who would be free, themselves must strike the blow?
By their right arms the conquest must be wrought?
Will Gaul or Muscovite redress ye? No!
True, they may lay your proud despoilers low,
But not for you will Freedom's altars flame.—
Shades of the Helots! triumph o'er your foe!
Greece! change thy lords, thy state is still the same;
Thy glorious day is o'er, but not thy years of shame.

Yet are thy skies as blue, thy crags as wild;
Sweet are thy groves, and verdant are thy fields;
Thine olive ripe as when Minerva smiled,
And still his honeyed wealth Hymettus yields;

There the blithe bee his fragrant fortress builds,
The free-born wanderer of thy mountain air:
Apollo still thy long, long summer gilds;
Still in his beam Mendeli's marbles glare;
Art, Glory, Freedom, fails, but Nature still is fair.*

A thousand other examples, of like effect, from like causes, might easily be adduced. Insomuch, that it has become a general maxim among political writers, that nations, like individuals, have a natural youth, perfection, and dissolution. It is a maxim, however, that must be received with some degree of caution. The experiment, notwithstanding that the world has now continued for nearly six thousand years, has never been tried in its hardier and colder regions; and we have already seen, that in the warmer climates, there is a cause operating towards the production of national decay, peculiar to itself, and distinct, therefore, from the law of general necessity. Yet, even in the warmer regions of the earth, the fact does not hold universally; for the Chinese have historic documents of the continuance of their empire for nearly four thousand years: one of the chief of which is, the famous record of an eclipse of the sun, in the reign of Ching-Kang, 2155 years before the commencement of the Christian era: while Persia, though conquered by the Romans, and shorn of more than half its extent in elder times, has still, under some form or another, descended to the present day, through a period of nearly three thousand years. And, wild and wandering as is the life of the Arab tribes, they may at least make a boast of having uniformly retained their customs, their liberty, and their language, for a longer period than any other people, and amidst all the changes that have befallen the most splendid empires around them; and are at this day, in habits, government, and national tongue, nearly the same as they were in the time of the patriarch Job; and probably as they were long before the earliest epoch to which the Chinese can make any pretensions.

There can be no doubt, however, that the very perfection of a people, in the arts of civilization and refinement, has a natural tendency to produce the seeds of future decay and dissolution; and although the Chinese and Arabians have not hitherto given proofs of any such change, it is only, perhaps, because they have for ages continued stationary, and have never reached the absolute perfection we are speaking of. I shall close the present lecture, therefore, with pointing out a few of those passions and other affections which immediately spring from what may be called the manhood, or summit of civilization, and chiefly distinctive of it, and pave the way for its downfal.

In order, however, to give strength and bearing to the picture, let us first glance at the passions and emotions of mankind in a simpler state; in that middle condition of moral cultivation usually to be met with in the villages and smaller towns of a highly-civilized people, where the moral affections have sweetened the heart, but refinement has not yet sweetened the manners. Let us transport ourselves for a few minutes to Wales, the Highlands of Scotland,† or the banks of the Garonne. In any of these regions we shall be received upon a proper introduction, and often without any introduction whatever, with an honest though a homely welcome; the chief virtues of the heart we shall find to be chastity, sincerity, frugality,

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[*] Childe Harold's Pilgrimage, cant. ii.

[†] See, for a correct description of the amusements, superstitions, and manners of the Scottish peasantry, Burns's *Halloween*, and his *Cottar's Saturday Night*.

and industry; its chief feelings, cheerfulness, content, and good-will: if they know little of the sublimer, they know nothing of the turbulent passions:—

> Far from the maddening crowd's ignoble strife,
> Their sober wishes never learn to stray;
> Along the cool sequester'd vale of life
> They keep the noiseless tenour of their way.

At the same time, we shall find an evident distinction of national character; the first of these tribes evincing an enthusiastic fondness for the shadowy traditions and the antiquated, perhaps the fabulous heroes of their country, from some of whom every one believes himself to be lineally descended; the second, an ardent attachment to their respective lairds, and the hardy individuals that compose their respective clans; and the third, an elastic and ebullient vivacity, that seems to fit them for happiness in any country, and almost under any circumstances.

If from these scenes of simple life and ingenuous manners, we pass to the crowded capital of refinement and luxury, we shall see more, perhaps, to admire, but certainly more to disrelish and weep over; a strange intermixture of the noblest virtues and the foulest vices; the mind in some instances drawn forth to its utmost stretch of elevation and genius, and in others sunk into infamy and ruin; a courtesy of attention that enters into all our feelings, and anticipates all our wants; delicacy of taste; punctilious honour; sprightly gallantry; splendour and magnificence; wit, mirth, gayety, and pleasure of every kind. Of national character, however, we find little or nothing: like the pebbles in a river, all roughnesses are smoothed away by mutual friction into one common polish. It is easy, indeed, to perceive that every thing tends to an extreme; the jaded taste becomes fastidious, and is perpetually hunting for something new; gallantry degenerates into seduction; fine, trembling honour, into an irritable thirst to avenge trifles; the heart is full of restlessness and fever. In the general pursuit of happiness, contentment is altogether unknown; no one is satisfied with his actual rank and condition, and is perpetually striving to surpass or supplant his neighbour; and striving, too, by all the machinery he can bring into play. Hence, in the more refined ranks, all is flattery, servility, and corruption; in the busy walks of traffic and commerce, all is wild venture, speculation, and hazard; the bosom is distracted with the civil warfare of avarice, ambition, pride, envy, and sullen rancour; the whole surface is at length hollow and showy, and the face becomes no index to the feelings. There is no necessity for dwelling on those open and atrocious villains, that, like vermin on a putrid carcass, such a state of things must indispensably generate and fatten;—the haggard tribe of anxiety, vexation, and disappointment—the downfal of splendour—the mortification of pride—the failure of friendship—the sting of ingratitude—the violation of sacred trusts—blasted expectations and disconcerted projects—the cup of joy dashed from the lips that are sipping it—hope shipwrecked on the verge of possession—the agony of the mighty adventurer, who for months beforehand sees the tempest of his ruin rolling towards him; sees it, but dares not meet it; sees it, but perhaps cannot avert it—harrowed through every nerve by the gaunt spectres of approaching shame, by the lamentations of his own family reduced to beggary, and the cutting rebukes of other families whom a misplaced confidence has involved in one common destruction—the demon train of distraction, madness, suicide:—these, and a thousand miseries such as these, that naturally flow from, and are naturally dependent upon, a state of superabundant and diseased refinement, without taking into the account the flagrant and atrocious villanies which fall within the cognizance of the criminal judge, are sufficient to prove, that the nation which has reached the utmost pitch of civil perfection, is in danger of degeneracy and decay; and justify the doubt I ventured to suggest, at the opening of the present lecture, as to which of the two extremes of society is pregnant with the greatest share of moral evils—that of gross barbarism, or that of an exuberant and vitiated polish.

LECTURE XI.

ON TEMPERAMENTS, OR CONSTITUTIONAL PROPENSITIES.

The social principle—that horror of solitude and inextinguishable desire of consorting with our own kind, which every man feels in his bosom, and which impels him to prefer misery with fellowship, to ease and indulgence without it—laid the first foundation for cities and states; and the nature of the social compact, peculiarity of climate, and community of habits and manners, unite in producing that general tissue of feelings and propensities, which constitutes, and is denominated, national character; which gives vivacity to the French, a refined taste to the Italians, phlegmatic industry to the Dutch, a free and enterprising spirit to the English, and a military genius to the Germans.

But independently of these national tendencies, that run through the general mass of a people, it is impossible for us to open our eyes without perceiving some peculiar propensity or prominent moral feature, in every individual of every nation whatever; and which, if strictly analyzed, will be found as much to distinguish him from all other individuals as the features of his face. This is sometimes the effect of habit, or of education, which is early and systematic habit, and which every one knows is capable of changing the original bent of the mind, and of introducing a new direction; but it is far more generally an indigenous growth, implanted by the hand of nature herself; or, in other words, dependent on the original organization, admitting of infinite varities, and produced by the ever-shifting proportions which the mental faculties and the corporeal organs bear to themselves, or to each other, and which it is impossible in every instance to catch hold of and classify.

The Greek physiologists, however, attempted the outlines of a classification; for they began by studying the individual varieties, which they ascribed to the cause just adverted to, and hence denominated them idiosyncrasies, or peculiarities of constitution.

They beheld, as every one must behold in the present day, for nature is ever the same, one man so irascible, that you cannot accidentally tread on his toe, or even touch his elbow, without putting him into a rage; another so full of wit and humour, that he would rather lose his friend than repress his joke; a third, on the contrary, so dull and heavy, that you might as well attempt to move a mile-stone: and possessing withal, so little imagination, that the delirium of a fever would never raise him to the regions of a brilliant fancy. They beheld one man for ever courting enterprise and danger; another distinguished for comprehensive judgment and sagacity of intellect: one peculiarly addicted to wine; a second to gallantry, and a third to both: one generous to profligacy; another frugal to meanness; and a few, amidst the diversified crowd, with a mind so happily attempered and balanced by nature, that education has little to correct, and is almost limited to the act of expanding and strengthening the budding faculties as they show themselves.

The physiologists of Greece, and especially the medical physiologists, did not rest here. They attempted to cluster the different species of idiosyncrasies, or particular constitutions that had any resemblance to each other, and to arrange them into genera, which were denominated crases (κρασης) or temperaments. We have the express testimony of Galen,* that Hippocrates was the founder of this system. He conceived the state or condition of the animal frame to be chiefly influenced by the nature and proportion of its radical fluids, at least, far more so than by those of its solids. The radical fluids he supposed to be four, the elementary materials of which were furnished by the stomach, as the common receptacle of the food; but each of which is dependent upon a peculiar organ for its specific production or secretion. Thus the blood he asserted to be furnished by the heart; the phlegm, lymph, or finer watery fluid, by the head; the yellow bile by the gall-duct; and the black bile by the spleen. The perfection of health, or hygéia, as the Greeks denominated it, he conceived to result from a due proportion of these fluids to each other; and the different temperaments or predispositions of the body, to peculiar constitutions or idiosyncrasies, from a disturbance of the balance, and a preponderating secretion or influence of any one of them over the rest.

Hence Hippocrates established four genera of temperaments, which he denominated from the respective fluids whose superabundance he apprehended to be the cause of them, the BILIOUS or CHOLERIC, produced by a surplus of yellow bile, and dependent on the action of the gall-duct or liver; the ATRABILIARY or MELANCHOLIC, produced by a surplus of black bile, and dependent upon the action of the spleen; the SANGUINEOUS, produced by a surplus of blood, and dependent upon the action of the heart; and the PHLEGMATIC, produced by a surplus of phlegm, lymph, or fine watery fluid, dependent upon the action of the brain.

This arrangement of Hippocrates continued in great favour with physiologists, and with very little variation, till the beginning of the last century, at which time it was warmly supported in all its bearings by the quaint but solid learning of Sir John Floyer.† And even to the present hour, notwithstanding all the changes that have taken place in the science of physiology, anatomy, and medicine, and the detection of some erroneous reasonings and opinions in the writings of Hippocrates upon this subject, intermixed with much that is admirable and excellent,—it has laid a foundation for all the systems of temperaments, constitutions, or natural characters, that have more lately been offered to the world. Most of these, however, have been distinguished by an introduction of five other genera, denominated a WARM, a COLD, a DRY, a MOIST, and a NERVOUS or irritable temperament: the first four of these five having been added to the list by Boerhaave, but unnecessarily, as they may readily be comprehended, as I shall presently show you, under the four simple temperaments of Hippocrates; while the fifth, in the general opinion of modern physiologists, is requisite to supply what must be admitted to be a chasm in the Greek hypothesis.

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* De Temperament. ii. p. 60. § b.

† See, his Physician's Pulse-Watch; or an Essay to explain the Old Art of Feeling the Pulse, and to improve it by the Help of the pulse-watch. 2 vols. 8vo. Lond. 1707.

I have dwelt the longer upon this subject, because it has an immediate and very extensive bearing upon the popular phraseology of the present day, in all nations; and will give us a clear insight into the meaning of various colloquial terms and idioms, which we are in the constant habit of employing, in many instances, without any definite signification.

The two usual words to express the moral disposition or propensity of a man, and especially as connected with the passions, are TEMPER and HUMOUR. Both are Latin terms: the first, in its original sense, imports mingling, compounding, modifying, or qualifying, and has an obvious reference to the combination of the four radical fluids just mentioned; on the peculiar *temper* or *proportion* of which to each other we have just seen that the Greek physiologists supposed the idiosyncrasy or peculiar constitution to depend: and hence TEMPER is, in a certain sense, synonymous with CONSTITUTION itself, though somewhat more generally applied to the frame of the mind than of the body.

HUMOUR, in like manner a Latin term, is derived from the Greek *χυμος* (chumos), and in its simple and radical sense imports moisture, juice, or fluid of any kind: in which sense we still employ the terms *humid* and *humidity*, derived from the same source. In physiology and popular language, HUMOUR is synonymous with TEMPER; and the explanation now offered will sufficiently show us how, from such a derivation, it comes to be employed as significative of mental disposition. Every one must see instantly, that, like the term temper, it has a reference to the general mass of the four radical fluids, which, upon the Greek hypothesis, are essential to the life of man; the peculiar combination of which with each other produces the peculiar HUMOUR or prevailing CURRENT of every individual. It is curious, and in many instances highly entertaining, to trace the transmutations of meaning that a word, from accidental circumstances, is thus frequently compelled to undergo, so as to express, in one age, a very different idea from what it had in a preceding. Even in the present day, however, and in common language, we still occasionally employ the term HUMOUR and its derivatives, in its original sense; as when we speak of the *humour* of the blood, meaning thereby a peculiar acrimonious fluid; and still more openly when we speak of the aqueous *humour* of the eye.

Humid and *humidity* continue steady to the radical idea, for they import fluidity and nothing else. Nay, so strongly have we imbibed the diffusive spirit of the Greek doctrine upon the subject before us, that we not unfrequently carry forward the same idea of fluidity without our being aware of it; as when, for example, we speak of a *vein of humour*, or *a humorous vein*, in which case we evidently refer to a fluid circulating in a canal. Thus Prior, in his well-known imitation of Adrian's lines to his soul:

> Thy *humorous* vein, thy pleasing folly,
> Lies all neglected, all forgot;
> And pensive, wav'ring, melancholy,
> Thou dread'st and hop'st thou know'st not what.

We are not only told, however, in popular language, that every man has his humour, or vein of humour, but that one man is of a *choleric* humour, or turn of mind, by which we mean, that he is naturally irascible, or inclined to anger; that another man has a *melancholic* turn, by which every one understands that he is naturally gloomy and low-spirited; that a third is of a *sanguine* disposition, importing that he is naturally prone to high hope and confidence; and that a fourth is of a *phlegmatic* habit, signifying that he is naturally dull and sluggish.

Now, in thus expressing ourselves, we show that we have imbibed, though often without being aware of it, not merely the language, but the first principles of the Hippocratic school, and employ their own terms as illustrative of their own doctrine. Choler (χολη), for example, is Greek for bile; and the bilious temperament of the Greeks was peculiarly characterized by irascibility, or an habitual propensity to anger. So melancholy (μελαγχολια) is literal Greek for black bile; that which, as I have already observed, they supposed to be produced by the spleen; and to the melancholic, or, as the Latins called it, atrabilious or black bile temperament, they, in like manner, ascribed a prevailing disposition to gloom or depression of spirits. Sanguine is a Latin term, importing blood; and to the sanguineous temperament, or that which, on their hypothesis, indicates a brisk and exuberant flow of blood, they attributed a propensity to ardent expectation, mirth, gayety. Phlegmatic (φλεγματικος), again, is a Greek term, denoting lymph or aqueous fluid; and to the temperament abounding with this cold and spiritless humour, as they conceived it to be, they referred habitual indolence or sloth.

We often hear of the term RULING PASSION: this is rather of modern than of ancient origin. It is frequently, however, employed without any clear meaning, and confounded with temper, humour, or idiosyncrasy. Now, the temper, or idiosyncrasy, may be the result of a combination of passions, in which case all of them cannot take the rule; and hence that only is, properly speaking, the ruling passion, which takes the lead of the rest, and gives to the particular temper or humour a particular variety. Pope has not always paid sufficient attention to this distinction. Roscommon has correctly maintained it in the following couplet:

> Examine how your HUMOUR is inclined,
> And which the RULING PASSION of your mind.

If this view of the subject be correct, it will follow that crases or temperaments are the genera or grand divisions under which the moral characters or dispositions of mankind, possessing any considerable degree of resemblance to each other, may be naturally arranged. Tempers, humours, or idiosyncrasies, are the species which compose the different genera and ruling passions, the varieties or singularities of emotion, by which one individual belonging to the same species is distinguished from another.

The species and varieties may be innumerable, and would require a folio volume for their separate analysis and description, rather than a single lecture. Let us, then, confine our attention to the genera, or primary division of moral and physical constitutions into temperaments, and illustrate this part of the preceding classification by a few familiar examples.

All mental propensities or dispositions, then, may be arranged under five separate heads; each of which constitutes a temperament, and is distinguishable by a correspondent effect, produced on the corporeal organs, and the external features and figure. So that the mind and body, for the most part, maintain a mutual harmony, and the powers of the one become in a general view, a tolerably fair index of those of the other. To these heads, genera, or temperaments, I have given the names of sanguineous, bilious or choleric, atrabilious or melancholic, phlegmatic, and nervous. These names and characters, as I have already observed, with the exception of the last, are derived from the Greek physiologists: the principles of animal chemistry on which they are founded, are, in many instances, erroneous; but the physiological facts which they are designed to illustrate are, for the most part, incontrovertible, and it is not easy to change the general arrangement for a better.

1. Let us commence with the SANGUINEOUS TEMPERAMENT, or that conceived to depend upon a powerful action or peculiar energy of the system of blood-vessels.

Suppose the heart and arteries, whose harmonious activity produces the circulation of the blood, and throws it over every part of the system, to possess a predominant energy of action, what may we reasonably expect to be the consequence? The pulse must be strong, frequent, and regular; the veins blue, full, and large; the complexion florid; the countenance animated; the stature erect; the figure agreeable, though strongly marked; the flesh firm, with a proportionate secretion of fat; the hair of a yellow, auburn, or chesnut colour; the nervous impressions acute; the perception quick; the memory tenacious; the imagination lively and luxuriant; the disposition passionate, but easily appeased; amorous, and fond of good cheer.

The diseases of this temperament are few but violent, and are chiefly seated in the circulating system; as hæmorrhages and inflammatory fevers. It shows itself with peculiar prominence in the season of spring; and especially in the season of youth, which is the spring of life. The best external or corporeal marks of the sanguineous temperament are, perhaps, to be met with in the beautiful statues of Antinous and the Apollo of Belvidere; the best moral character of it in the lives of Alcibiades and Marc Antony, as drawn by the masterly hand of Plutarch; and the most perfect type of this construction which has been offered in modern times, is to be found, in the judgment of M. Richerand, from whom I have copied the chief part of this description, in the person of the celebrated duke de Richelieu.*

If men of this temperament devote themselves to labour of any kind, that demands great muscular exertion, the muscles thus brought into action, and easily supplied with nutrition from the sanguineous system, will acquire considerable increase of size, and produce a subdivision of the sanguineous temperament, which is usually known by the name of ATHLETIC OR MUSCULAR. In this case, the head is very small; the neck very strong, particularly behind; the shoulders are broad; all the muscles are powerful and prominent, surrounded with strongly marked interstices or cavities; while the joints, and parts not abounding in muscles, are extenuated, and the direction of the tendons beneath them is obvious and striking. Perhaps the best model we possess of this peculiar constitution is the Farnesian Hercules, of which a good copy is to be found in the hall of the Royal Academy at Somerset-house, and must have been seen by every one who frequents the annual exhibitions of that establishment.

It is this temperament which is bestowed by Homer upon Ajax, and enables him, after receiving the shock of a mountain crag upon his shield, hurled at him by Hector, to return a still heavier and more effective blow.

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* Nouveaux Elemens de Physiologie, &c. tom. ii. sect. ccxxix. p. 445. 8vo. Paris, 1804.

Then Ajax seized the fragment of a rock,
Applied each nerve, and, swinging round on high,
With force tempestuous, let the ruin fly.
The huge stone, thundering, through his buckler broke;
His slacken'd knees received the numbing stroke.
Great Hector falls extended on the field,
His bulk supporting on the shatter'd shield.

These verses have been deservedly admired for their strength, and they do ample justice to the original. But the whole falls far short of the fearful and majestic energy displayed by Spenser in his description of the combat between the Giant and the Red-cross Knight, and particularly the overweening force with which the former wielded his enormous club, and aimed to despatch the champion by a single stroke, who had the good fortune to elude it, and amply to repay himself on his foe.

As when almightie Jove, in wrathfull mood,
To wreake the guilt of mortall sins is bent,
Hurles forth his thundring dart with deadly food,
Enrold in flames, and smouldring dreriment,
Through riven cloudes and molten firmament.—
The fierce three-forked engin, making way,
Both loftie towres and highest trees hath rent,
And all that might his angry passage stay;
And, shooting in the earth, castes up a mount of clay.

His boystrous club, so buried in the grownd,
He could not rearen up againe so light
But that the Knight him at advantage fownd;
And, whiles he strove his combred clubbe to quighte
Out of the earth, with blade all burning bright
He smott off his left arme, which, like a block,
Did fall to ground, depriv'd of native might;
Large streames of blood out of the trunckled stock
Forth gushed, like fresh-water stream from riven rocke.*

In this subdivision of the temperament before us, we meet with no degree of acuteness of external impressions or mental perception. Muscular strength, combined with mental tranquillity, is the prominent character: the individual, therefore, is not easily roused; but when he is so, he surmounts every resistance. It would be difficult to find in history a man of this peculiar constitution, whose intellectual faculties have been sufficient to acquire him an immortal fame. To become distinguished in the career of the sciences and fine arts, an exquisite sensibility is indispensable; a condition at utter variance with the full perfection of muscular masses.

II. The second temperament or general character I have noticed, is the CHOLERIC OR BILIOUS. The liver and biliary organs in general are here as redundant in their power as the sanguineous vessels, and for the most part at the expense of the excernent, or cellular and lymphatic system. The pulse, as in the last kind, is strong and hard, but somewhat more frequent; the veins cutaneous and projecting; the sensibility acute and easily excited, with a capacity of dwelling for a long time on the same object. The skin is brownish, with a tendency to yellowness; the hair black or dark-brown; the body moderately fleshy; the muscles firm and well marked; the figure expressive. The temper of the mind exhibits abruptness, impetuosity, and violence of passion; hardihood in the conception of a project, steadiness and inflexibility in pursuing it, and indefatigable perseverance in its execution. It is to this temperament we are to refer the men, who, at different periods, have seized the government of the world. Hurried forward by courage, audacity, and activity, they have all signalized themselves by great virtues or by great crimes, and have been the terror or the admiration of the universe. Such were Alexander, Julius Cæsar, Brutus, Attila, Mahomet, and Charlemagne, in earlier periods; and such in latter times as Richard III., Tamerlane, Cromwell, Nadir Shah, Charles XII. of Sweden, and the tyrant of our own day, Napoleon Buonaparte.

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* Faerie Queene, b. i. cant. viii. 9, 10.

This temperament, like the last, which is so closely connected, is characterized by a premature appearance of the moral faculties. The men I have just named when merely emerging from youth, are well known to have conceived and executed enterprises that would have been worthy of their maturest judgment. Where the lineaments of this character are peculiarly strong, and the susceptibility, as frequently occurs, is very acute, the individuals are highly irascible, and launch into a passion from very trivial causes.* Homer has ascribed this part of the general temperament to many of his heroes, particularly to Achilles; and every politician knows that it was a prominent feature in the constitution of Buonaparte, who seems, indeed, in the occasional insults he offered to many of the highest characters at his own court, and in the general presence of his court, to have copied from the Grecian chieftain, who thus addressed Agamemnon, the head of the Grecian princes, the *αναξ ανδρων*, presiding at a general council, in reply to Agamemnon's reprimand:

> O monster! mix'd of insolence and fear,
> Thou dog in forehead, but in heart a deer!
> When wert thou known in ambush'd fights to dare,
> Or nobly face the horrid front of war?
> 'Tis our's the chance of fighting fields to try;
> Thine to look on, and bid the valiant die.
> So much 'tis easier through the camp to go,
> And rob a subject, than despoil a foe.
> Scourge of thy people, violent and base!
> Sent, in Jove's anger, on a slavish race;
> Who, lost to sense of generous freedom past,
> Are tamed to wrongs, or this had been thy last.

In this temperament we discover, as I have already observed, an union of an active exuberant bilious, with an active exuberant sanguineous system. The temperament called bilious is, therefore, properly speaking, a complex genus, deriving its features from both systems, and from both in a state of energetic operation.

III. If we put away this predominant energy of the sanguineous system, or sink it below its level, if we suppose the bilious system alone predominant, and then add a deranged action of some abdominal organ, or of the nervous department—the vital functions, from the change we have now taken for granted in the sanguineous system, being carried on in a weak and irregular manner, we shall arrive at the ATRABILIOUS, BLACK-BILE, OR MELANCHOLY TEMPERAMENT. The skin will assume a deeper tinge; the countenance appear sallow and sad; the bowels will be inactive, all the excretions tardy, the pulse hard, and habitually contracted. The corporeal sadness exerts an influence over the cast of ideas; the imagination becomes gloomy, the temper full of suspicion. The species and varieties afforded by this genus are almost innumerable, for the causes are peculiarly diversified. Hereditary disease, long-continued sorrow, incessant study, habitual gluttony, the abuse of pleasures of various kinds, and a thousand other circumstances, may equally become sources of this distressing condition, under some shape or other. And perhaps Le Clerc is correct in regarding it, in his Natural History of Man, as in every instance a morbid affection, rather than a natural and primitive constitution.

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* Richerand, ut supra, sect. ccxxxi. p. 449.

The character of Tiberius, of Louis XI., and of Pygmalion, as drawn by the nice hand of Fenelon in his Telemachus, give striking elucidations of this temperament in its moral bearings. M. Richerand has also pointed out examples in Torquato Tasso, Pascal, Gilbert, and Zimmerman; but perhaps the most perfect picture that has been furnished to the world is to be found in the life of the celebrated Jean-Jaques Rousseau.

IV. Let us pass on to the fourth temperament—the PHLEGMATIC, LYMPHATIC, PITUITOUS, or WATERY, for the terms are all synonymous, and by all these terms it has been denominated. The proportion of fluids is here too considerable for that of the solids, or, in other words, the excernent system which secretes them from the general mass of the blood is in peculiar activity; and the result is, that the body obtains an increased bulk from the repletion of the cellular texture. The fleshy parts are soft; the skin fair; the hair flaxen or sandy; the pulse weak and slow; the figure plump, but without expression; all the vital actions more or less languid; the memory little tenacious, and the attention wavering; there is an insurmountable desire of indolence, and aversion to both mental and corporeal exercise.

It is not to be wondered at, therefore, that, among the illustrious lives of Plutarch, we do not meet with an individual of this character. They are for the most part a good-natured group, not formed for the transaction of public affairs, who have never disturbed the earth by their negotiations or their conquests, and are rather to be sought for in the bosom of private life than at the helm of states. The Emperor Theodosius may, perhaps, be offered as an example of earlier times; and in our own day the deposed Charles IV. of Spain, who resigned himself altogether into the hands of the infamous Godoy, surnamed Prince of the Peace; Augustus king of Saxony, who resigned himself equally into the hands of Buonaparte; and Ferdinand of Sicily, who in a lucky hour, but of too short duration, at length surrendered the government of his people to our own country.

V. The last temperament I have noticed is the NERVOUS or IRRITABLE; as it has been sometimes, but incorrectly denominated. In this constitution the sentient system, or that susceptible to external impressions, is predominant over all the rest. Like the melancholic, it is seldom natural or primitive, but morbid and secondary, acquired by a sedentary life, reiterated pleasures, romantic ideas excited by a long train of novel or other fictitious and elevated histories; and peculiarly distinguished by a promptitude but fickleness of determination, vivacity of sensations, small, soft, and wasted muscles, and generally, though not always, a slender form. The diseases chiefly incident to it are hysterical and other convulsive affections.

Let us close with two brief remarks upon the general survey before us. The first is, that these temperaments or generic constitutions are pepetually running into each other; and consequently, that not one of them, perhaps, is to be found in a state of full perfection in any individual. Strictly speaking, Mr. Pitt and Mr. Fox belonged equally in the main to the second of them: there was the same ardour, genius, and comprehensive judgment in both: but the former had the bilious temperament, with a considerable tendency to the sanguineous; and hence, with more irritability, had more self-confidence, audacity, and sanguine expectation: the latter, while possessing the same general or bilious temperament, was at the same time more strongly inclined to the lymphatic; and hence his increased corporeal bulk; and with less bold and ardent expectation, he possessed one of the sweetest and most benevolent dispositions to be met with in the history of the world. The first was formed to be revered the second to be beloved; and both to be admired and immortalized.

The closing remark I have to submit is, that each of these temperaments, how widely soever they may differ from each other, is capable of being transmuted into any of the rest. Galen has particularly dwelt upon this most important fact, and has especially observed that a man of the most elevated and sanguineous constitution, may be broken down into a melancholic habit by a long series of anxiety and affliction; while, on the other hand, the most restless and audacious of the bilious or choleric genus may be attuned to the sleek quiet of the phlegmatic temper by an uninterrupted succession of peaceful luxury and indulgence. Of what moment is this well-established fact in the nice science of education! The temperaments of boys may be born with them; but they are capable of alteration, nay, of a total reversion, both in body and mind, each of which may be made to play upon the other; the one by a discipline of gymnastic exercises, and the other by a discipline of intellectual studies. The Greeks were thoroughly aware of this mutual dependence; and hence, as we have already seen,* made gymnastic games a regular part of the tuition of the academy; thus rearing at one and the same time, and rearing too, in the self-same persons, a race of heroes and of sages, and turning the wild and savage luxuriance of nature to the noblest harvests of wisdom and virtue.

LECTURE XII.

ON PATHOGNOMY, OR THE EXPRESSION OF THE PASSIONS.

In our last lecture, we examined how far the state of the body has an influence upon that of the mind: in the study we are now entering upon we shall take the opposite side of the question, and examine how far the state of the mind has an influence upon that of the body.

This influence, if it exist, may be either instantaneous or permanent: it may be produced by some sudden affection or emotion of the mind, exciting an abrupt change in the features, the muscles, or other soft and flexible parts of the body; or it may result from the habitual character of the moral propensity, slowly and imperceptibly operating on parts that are less pliant, and giving them a fixed and determinate cast. The former constitutes the study of Pathognomy, or of the signs, language, or expression of the passions: the latter, the study of physiognomy, or of the signs, language, or expression of the genius or temper.

* Ser. II. Lect. XI.

Let us investigate each of these in the order in which I have now stated them ; and devote our present attention to the former of the two.

Suppose a man of a mild but courageous disposition, reclining at ease, and alone, beneath some overspreading forest tree, on a summer's evening, should be suddenly surprised by the attack of a ruffian, who should attempt to rob or murder him ;—what would be the change of feelings and of figure he would undergo ? The tranquillity of his mind would be transmuted into horror, rage, and probably revenge, or an attempt to retaliate ; while the negligent ease of his posture, the relaxed muscles of his face, the natural vermeil of his cheeks, his half-opened lips, half-closed eyelids, and easy breathing, would suddenly start into tension, energy, suffusion : he would be instantly on his feet, in an attitude of determined resistance ; still trembling with fear, he would collect all his soul into a strong and desperate effort to overcome the wretch : his muscles would swell with violent rigidity ; his heart contract with unusual force and frequency; his lungs heave powerfully ; the whole visage become inflated, dark, and livid ; the eye-balls roll and look wildly ; the forehead be alternately knit, and worked into furrows ; the nostrils would open their channels to the utmost; the lips grow full, stretch to the corners of the mouth, and disclose both rows of teeth, fixed and grinding upon each other ; the hair stand on end, and the hands, spasmodically clenched, or grasping and grappling with the assassin.

Now it has been made a question, whether these rapid and violent movements are instinctive signs of the passions prevailing in the mind, or voluntary muscular exertions, called for by the stress of the case, and constituting the means of resistance. Which opinion soever be adopted, it must be allowed to run parallel with the whole range of internal passions, and external expressions. And hence, the advocates for the latter principle contend, that the various transitions of feature, position, and attitude, which accompany the different emotions of the mind, and indicate their nature, are, in every instance, the effect of habit, or are suddenly called forth, to operate some beneficial purpose. It is from experience alone, we are told, that we are able to distinguish the marks of the passions ; that we learn, while infants, to consider smiles as expressions of kindness, because they are accompanied by endearments and acts of beneficence ; and frowns, on the contrary, as proofs of displeasure, because they are followed by punishment. So in brutes, it is added, the expression of anger is nothing more than movements that precede or prepare the animal for biting ; while that of fondness is a mere fawning or licking of the hand. The glare of an enraged lion is the mere consequence of a voluntary exertion to see his prey more clearly ; and his grin, or snarl, the natural motion of uncasing his fangs, before he uses them.*

I cannot readily adopt this hypothesis, as applied either to man or to quadrupeds. The power of expression possessed by the latter is, doubtless, far more limited, than that possessed by the former ; but brutes still have expression, and that too, in the face, as well as in the general movements of the body ; and expression, moreover, dependent upon the peculiar frame or feeling of the sensory, and therefore as strictly its genuine and specific symbols, as words are the symbols of ideas. In man, indeed, the changes of the countenance seem to proceed upon a systematic provision for this purpose ; they constitute a natural language, and this so perfectly that there is not an emotion in the mind which is without its appropriate sign; whilst we meet with various muscles in the face, which have no other known use than that of being subservient to this important purpose: particularly those that knit the eyebrow into an energetic and irresistible meaning; and those of the angle of the mouth, employed in almost every motion of this organ expressive of sentiment; but peculiarly and forcibly called into action in that arching of the lip which is the natural sign of contempt, hatred, or jealousy.

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* Essays on the Anatomy of Expression in Painting, by Charles Bell, p. 84. 4to. 1806.

Mr. Charles Bell, to whom we are indebted for an elegant and admirable treatise on the anatomy of expression in painting, supports this last opinion; but rejects the doctrine of instinctive expression in the face of quadrupeds; contending, that even in the passion of rage, by far the most strongly marked on the countenance, the changes which take place in the features are nothing more than motions accessory to the grand object of opposition, resistance, and defence.* The inflamed eye, however, and fiery nostrils of the bull, can scarcely be ascribed to this cause; for they add nothing to the power of striking: they may, indeed, be proofs or effects of the general excitement; but to say this, is to say nothing more than that they are proofs or effects of the passion they indicate; and consequently its natural language or expression. They are never employed on any other occasion. "In carnivorous animals," observes Mr. Bell, "the eyeball is terrible, and the retraction of the flesh of the lips indicates the most savage fury. But the first is merely the excited attention of the animal, and the other a preparatory exposure of the canine teeth." Now if the first be merely excited attention, we must meet with it in every instance in which the mere attention of carnivorous animals, and nothing but the mere attention, is called forth. But is the glaring and terrible eyeball here alluded to a mark of simple attention? Has any one ever seen it so in any animal, whether carnivorous or graminivorous, quadruped, biped or footless? Has he ever seen it exhibited on such occasion, I will not say constantly and invariably, as upon this opinion it ought to be, but in a single case of simple attention? And in like manner, I may ask respecting the tremendous retraction of the flesh of the lips, and exposure of the teeth,—not merely of the canine teeth or tusks, as stated above, but of all the teeth of both jaws, as far as such retraction will allow—has any one ever witnessed this movement in the action of mere seizing or biting, as, for example, in the case of devouring food? Mr. Bell himself seems sufficiently to settle this point, by telling us, in the beginning of the passage I have just quoted, that the "retraction of the flesh of the lips indicates the most savage fury." And I may add, it indicates nothing else; it is not wanted, and is never made use of, in the muscular movement of mere biting, and consequently is an immediate symbol of the passion called into exercise. It commences with the commencement of this passion, and is limited to its continuance and operation.

What, then, it may be asked, is the use of external expression, in instances of this kind, if it do not add to the power of defence or resistance? The proper answer must be found in the general object and intention of nature upon the whole of the case before us.

Man, by his constitution, is designed for society and mental intercourse. But what is to draw him to his fellows? to strip him of timidity and reserve, and fix him in communion and confidence? The language of expression—the natural characters of the countenance—the softened cheek—the smiling lip—the beaming eye—the mild and open forehead—the magic play of the features in full harmony with each other;—which tell him, and, where artifice does not mimic nature, tell him infallibly, that the mind to which they belong, is all sympathy, benevolence, and friendship, and will assuredly return the confidence it meets with. But we have sufficiently seen in the last two lectures, that the mind is not always thus constituted; that at times it is the storehouse of rage, revenge, malevolence, suspicion, and jealousy; and that to confide in it would be misery and ruin. How is a man to be on his guard on such an occasion? He again looks at the countenance, and, instead of being attracted, he is instantly repelled: the characters are now hideous; and the Almighty, as formerly upon Cain, has set a mark upon the forehead, that it may be known.

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* Essays, &c. by Charles Bell, edit. 1. pp. 85, 86.

Such, then, is the real use of that instinctive language of the features which is perpetually interpreting the condition of the mind; a language of the highest importance, and of universal comprehension; and which, if ever disguised and fallacious, is almost infinitely less so than that of the lips or language. Its characters are most perfect in mankind; but they are occasionally to be traced in quadrupeds: below which class, however, the signs of the passions, whether sought for in the face, or in any other organ, grow gradually more indistinct; or, perhaps, from our knowing less of the manners and expression of the inferior classes, they appear so to ourselves, though not so in reality to others of the same kinds.

Nec ratione alia proles cognoscere matrem
Nec mater posset prolem; quod posse videmus;
Nec minus, atque homines, inter se nota cluere.*

Hence alone
Knows the fond mother her appropriate young,
Th' appropriate young their mother, mid the brutes
As clear discern'd as man's sublimer race.

In contemplating, then, the passions, or other affections of the mind, as cognisable by external characters, they easily resolve themselves into two descriptions—the ATTRACTIVE and the REPULSIVE; the signs of which are to be sought for in man, and the nobler ranks of quadrupeds, chiefly in the face, but considerably also in the attitudes and motions of the body; while, in other animals, we are so little acquainted with these signs, as to be incapable of offering any very satisfactory or extensive opinion upon the subject.

In the ATTRACTIVE AFFECTIONS, the features, limbs, and muscles are uniformly soft and pliant—in the REPULSIVE, as uniformly tense, and for the most part rigid. The characters of the latter, therefore, are necessarily more marked and imposing than those of the former, though both are equally true to their purpose. And in more definitely answering the question, whether the characters in either case be the effect of habit or voluntary exertion to execute the feeling of the mind at the moment, or whether they be the mind's natural and instinctive symbols; it may be still farther observed, that in all instances they are the latter, and in a few instances both; for it by no means follows, that they are not instinctive symbols, because they serve at the same time to ward off our danger, or to inflict retaliation on an assailant. In the attractive feelings or passions, they are perhaps, for the most part, instinctive signs alone: for the natural language of dimples, smiles, laughter, a lively, sparkling eye, or that softened outline, and uniform sweep of the whole figure which every one knows to be indicative of tranquillity and repose, is so clear to every one, that he who runneth may read it, and be assured of finding a contented and happy companion, if not a propitious season for a suit the heart is set upon. And although in a few of the repulsive passions, as rage, terror, and revenge, I have already given examples of their being mixed modes, in the greater number of even this last class they are probably as simple instincts as in the whole of the former. For what other use than that of mere instinctive indications can we possibly assign to tears, sighs, frowns, erection of the hair of the head, or the dead paleness, shivering, and horripilation, the creeping cold, that makes the multitude of the bones to tremble, under the influence of severe terror or dismay?

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* De Rer. Nat. ii. 349.

In all this, there is one fact peculiarly worthy of attention; and that is, the admirable simplicity which runs through the whole; so that the same muscles are not unfrequently made use of to produce different and even opposite effects: and this, too, by variations, and shades of variations, so slight, that it is difficult, and in some cases almost impossible, to seize them with the pencil. When Peter of Cortona was engaged on a picture of the iron age, for the royal palace of Pitti, Ferdinand II., who often visited him, and witnessed the progress of the piece, was particularly struck with the exact representation of a child in the act of crying. "Has your majesty," said the painter, "a mind to see how easy it is to make this very child laugh?" The king assented; and the artist, by merely depressing the corner of the lips and inner extremity of the eyebrows which before were elevated, made the little urchin, which at first seemed breaking its heart with weeping, seem equally in danger of bursting its sides with immoderate laughter. After which, with the same ease, he restored the figure to its proper passion of sorrow.

The nerves that influence the expression take their rise almost entirely from one common quarter, the medulla oblongata, or that lower portion of the brain from which the spinal marrow immediately issues;* and as all their chief ramifications associate in the act of respiration, we can readily see why the lungs, the heart, and the chest, in general, should so strikingly participate in all the changes of expression, and work up alternately sighs, crying, laughter, convulsions, and suffocation.†

I have said, that under the repulsive passions the muscles and features are for ever on the stretch; though the tension is often irregular and alternately softens and stiffens. This general remark will apply to grief, pain, and agony; rage, suspicion, and jealousy; horror, despair, and madness; though, as I have formerly observed, this last affection cannot with strict propriety be introduced among the passions, being a mental disease rather than a mental emotion.

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* See Ser. I. Lect. XV.

† This subject has been of late perspicuously and admirably pursued by Mr. Bell, in a series of communications to the Philosophical Transactions, and especially in the Volume for 1822, p. 284, who closes his remarks as follows: "To those I address, it is unnecessary to go further than to indicate that the nerves treated of in these papers are THE INSTRUMENTS OF EXPRESSION, from the smile upon the infant's cheek to the last agony of life. It is when the strong man is subdued, by this mysterious influence of soul and body, and when the passions may be truly said TO TEAR THE BREAST, that we have the most afflicting picture of human frailty and the most unequivocal proof that it is the order of functions which we have been considering that is then affected. In the first struggles of the infant to draw breath, in the man recovering from a state of suffocation, and in the agony of passion, when the breast labours from the influence at the heart, the same system of parts is affected—the same nerves, the same muscles; and the symptoms or characters have a strict resemblance. These are not the organs of breathing merely, but of natural and articulate language also, and adapted to the expression of sentiment, in the workings of the countenance and of the breast; that is, by signs as well as by words."

Let me justify this remark by a few illustrations. "A man in great PAIN," observes Mr. Burke, "has his teeth set; his eyebrows are violently contracted; his forehead is wrinkled; his eyes are dragged inwards, and rolled with great vehemence; his hair stands on end; his voice is forced out in short shrieks and groans; and the whole fabric totters."*

In GRIEF, there is still more violence and tension, though the tension is irregular and alternating. Where the grief is of long continuance, and deeply rooted, it gives a pale and melancholy cast to the countenance; an air of reserve to the manner; and an emaciation to the entire form; as though the sad sufferer were fondly nursing the viper passion that devours his bosom. Such is the exquisite description of Viola, as given of herself in the Twelfth Night:—

> She never told her love,
> But let concealment, like a worm i' th' bud,
> Feed on her damask cheek. She pined in thought;
> And, with a green and yellow melancholy,
> She sat like patience on a monument,
> Smiling at grief.

At other times, the passion is characterized by a mingled tumult of agitation, restlessness, and bitter bewailing. Such is the general picture of Constance, in King John; who thus, among other exclamations, weeps over the ill-fated Prince Arthur:—

> Grief fills the room up of my absent child;
> Lies on his bed; walks up and down with me;
> Puts on his pretty looks; repeats his words;
> Remembers me of all his gracious parts;
> Stuffs out his vacant garments with his form:
> —Then have I reason to be fond of grief.

In RAGE, there is the same tension, but the same irregular agitation of the muscles. "The features," as Mr. Bell justly observes, "are unsteady; the eyeballs are seen largely; they roll, and are inflated. The front is alternately knit and raised in furrows, by the motion of the eye-brows; the nostrils are inflated to the utmost; the lips are swelled, and, being drawn, open the corners of the mouth;† the muscles are strongly marked. The whole visage is sometimes pale, sometimes inflated, dark, and almost livid; the words are delivered strongly through the fixed teeth; the hair is fixed on end, like one distracted; and every joint should seem to curse and ban." Perhaps the finest picture of this mighty passion ever presented to the world, is to be found in Tasso's description of the combat between Tancred and Argante: but it is too long for quotation, and would lose half its spirit if given in any other language than the original.

It is in the features of rage that the higher kinds of quadrupeds make the nearest approach to this form of expression in man. The bull terribly denotes it, by his inflamed eye, wide and breathing nostrils, and the prone position of his sturdy head, waiting the due moment to strike his antagonist to the ground. But of all quadrupeds, not perhaps excepting the lion, the war-horse exhibits the loftiest and most imposing character. The noblest and truest description of him that has ever been painted is in the book of Job. Allow me to quote it somewhat more correct to the original than the rendering in our common version, which is nevertheless, in the main, unexceptionable :—

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* Sublime and Beautiful, part iv. sec. 3. Cause of Pain and Fear.

† Anatomy of Painting, p. 139.

Hast THOU bestowed on the horse mettle?
Hast thou clothed his neck with the thunder-flash?
Hast thou given him to launch forth as an arrow?
Terrible is the pomp of his nostrils:
He paweth in the valley, and exulteth;
Boldly he advanceth against the clashing host;
He mocketh at fear, and trembleth not;
Nor turneth he back from the sword.
Against him rattleth the quiver,
The glittering spear, and the shield;
With rage and fury he devoureth the ground,
And is impatient when the trumpet soundeth.
He exclaimeth among the trumpets "aha!"
And scenteth the battle afar off,
The thunder of the chieftains, and the shouting.

JEALOUSY is a fitful, unsteady passion: but still the muscles are constantly more or less on the stretch; "the eyelid is fully lifted, and the eyebrows strongly knit, so that the eyelid almost entirely disappears, and the eyeball glares from under the bushy eyebrow. There is a general tension on the muscles, which concentrate round the mouth; and the lips are drawn so as to show the teeth, as in great pain or fury. Much of the character of the passion, however, consists in rapid vicissitudes from love to hate; now absent, moody, and distracted; now courting love; now ferocious and revengeful. It is hence difficult to represent it in painting. In poetry alone can it be truly represented in the vivid colours of nature; and even of poets, Shakspeare, perhaps, is the only one who has shown himself quite equal to the task."* It is thus he describes the workings of Othello's heart, on his first crediting the slander of the seduction of Desdemona by Cassio :—

O that the slave had forty thousand lives!
One is too poor, too weak, for my revenge.
Now do I see, 'tis true:—look here, Iago,—
All my fond love—thus do I blow to heaven.—
'Tis gone.——
Arise, black Vengeance, from the hollow hell!
Yield up, O Love! thy crown and hearted throne
To tyrannous Hate!—swell, bosom, with thy fraught,
For 'tis of aspics' tongues.

The general expression and features of FEAR, Mr. Burke has compared to those of severe pain. Mr. Charles Bell objects to this; but Mr. Burke does not mean simple fear, but terror; which, as we observed in a former lecture, is FEAR united to an active IMAGINATION; and in this sense of the passion, Homer has frequently employed it: witness the emotion of Priam upon the first tidings of the death of Hector :—†

Terror and consternation at the sound
Thrill'd through all Priam's soul: erect his hair,
Bristled his limbs, and with amaze he stood,
Mute and all motionless.

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* Bell, ut supra, p. 137.

† Il. lib. xxii. 405.

The extreme of this kind of terror is DISTRACTION: the total wreck of hope, the terrible assurance of utter and inextricable ruin. The expression of distraction or despair must vary with the action of the distress. Sometimes it will assume a frantic and bewildered air, as if madness were likely to afford the only relief from mental agony. Sometimes there is at once a wildness in the looks, and a total relaxation and impotency of the muscles, as if the wretch were falling into insensibility; a horrid gloom, and an immovable eye, while yet he hears nothing, he sees nothing, and is unconscious of every thing around him. Such is the description of despair, as given in the well-known passage of Spenser:—

> The darksome cave they enter, wher they find
> That cursed man, low sitting on the ground,
> Musing full sadly in his sullein mind:
> His griesie lockes, long growen and unbound,
> Disordered hong about his shoulders round,
> And hid his face, through which his hollow eyne
> Lookt deadly dull, and stared as astound,
> His raw-bone cheekes, through penurie and pine,
> Were shronke into his iawes, as he did never dine.*

The best picture of this passion is Hogarth's, whose scene is admirably chosen, and consists of the gaming-house, with its horrible implements and furniture, in which the maddening sufferer had thrown his last stake, and met his utter ruin.

Tension, then, permanent or alternating, is the main character of the violent and repulsive passions; but if the attack be abrupt and intolerably vehement, the nervous system becomes instantaneously exhausted, as by a stroke of lightning; and the muscles are instantly relaxed, paralyzed, and powerless. Milton has given us an exquisite exemplification of this in the following picture of Adam, immediately after the first deadly transgression:—

> On th' other side Adam, soon as he heard
> The fatal trespass done by Eve, amazed,
> Astonied stood, and blank! while horror chill
> Ran through his veins, and all his joints relax'd.
> From his slack hand the garland wreath'd for Eve
> Down dropp'd, and all the faded roses shed.
> Speechless he stood, and pale.

But let us turn to a pleasanter subject. I have said, that in the expression of the attractive passions all is flexible and pliant. Their characters are necessarily less powerful, and many of them are common to the entire class.

In perfect tranquillity and content of mind, when all the passions are lulled into a calm, and the gentle spirit of imagination alone is stirring on the surface of the mental lake, there is, as I have already observed, a softened outline, a smooth and uniform sweep of the entire figure; every feature of the body uniting in the repose of the soul. Such is often the picture of him who loves Nature for her own sake, and listens with soothing meditation, amidst the steeps, the woods, or the wilds, that stretch their romantic scenery around him; and calls for no companions, for he feels no solitude.

> To sit on rocks, to muse o'er flood and fell,
> Slowly to trace the forest's shady scene,

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* Faerie Queene, b. i. cant. ix. xxxv.

Where things that own not man's dominion dwell,
And mortal foot hath ne'er or rarely been;
To climb the trackless mountain all unseen,
With the wild flock that never needs a fold;
Alone o'er steeps and foaming falls to lean;
This is not solitude; 'tis but to hold
Converse with Nature's charms, and see her stores unroll'd.*

But let this tranquillity be broken in upon by any of the agreeable passions, and still something of the same softness and pliancy of feature will remain; and the changes will be neither numerous nor powerful. This remark may be strikingly verified by turning to Le Brun; and still more so by turning to other French pathematists, who have still further subdivided the passions. In ADMIRATION and agreeable SURPRISE, there is a slight muscular agitation; and a gentle advance to stretching or teneseness in simple attention, veneration, and elevated revery; but there is no constraint. The whole is calm, placid, and void of exertion. Rapture and laughter make a somewhat nearer approach to the former qualities, and especially the low broad grin of the Dutch painters; but the muscles, though stretched, are still flexible and at ease. In eager DESIRE we approximate more closely the tension of the violent and repulsive passions: but eager desire is a compound emotion; it is desire with uneasiness, and consequently borders upon pain, if it do not enter its boundary.

Hence the attractive affections are far more easy to be expressed by the painter than by the poet, and fall immediately within the range of classical sculpture, which limits itself to the calm and the dignified, and has rarely been known to wander into the regions of intensity, distortion, or violence.

The poet, incapable of catching those transient lights and shades, that unutterable play of feature into feature, by which the passions of this class are chiefly distinguished from each other, is compelled to have recourse to collateral imagery, complex personification, or allegorical accompaniments. To this remark it will be difficult to find an exception in any writer. Let us take Collins as an example, who is one of the best and boldest of our lyric bards. His description of Hope, in his celebrated Ode to the Passions, is exquisitely fine, but, after all, somewhat indefinite; the whole of its figure being that of a beautiful nymph, with fair eyes, an enchanting smile, and wavy golden hair, accompanied with a lyre or some other instrument, for we are not told what, which she strikes to a song of future or prospective pleasure, amidst the echo of surrounding and responsive rocks, and woods, and valleys.

But thou, O Hope, with eyes so fair,
   What was thy delighted measure?
   Still it whisper'd promised pleasure,
And bade the lovely scenes at distance hail.
Still would her touch the strain prolong,
   And from the rocks, the woods, the vale,
She call'd on Echo still through all the song.
   And where her sweetest theme she chose,
   A soft responsive voice was heard at every close,
And HOPE enchanted smiled, and waved her golden hair.

The portrait is graceful, elegant, and animated; but I may venture to say, that the only real expression of the character of Hope is derived, not from the features of her person, but from the subject of her song, the whisper of promised pleasure, the hail of distant scenes. I say not this, however, as a proof of the imperfection of the artists, but of the art itself.

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* Childe Harold's Pilgrimage, canto ii.

Let us try another description from the same captivating production. The *mellow horn* having just been sounded and laid down by MELANCHOLY, the poet proceeds as follows:

> But O how alter'd was its sprightlier tone
> When CHEERFULNESS, a nymph of healthiest hue,
> Her bow across her shoulders slung,
> Her buskins gemm'd with morning dew,
> Blew an inspiring air, that dale and thicket rung,
> The hunter's call, to Faun and Dryad known.
> The oak-crown'd sisters and their chaste-eyed queen,
> Satyrs and sylvan boys were seen
> Peeping from forth their alleys green;
> Brown Exercise rejoiced to hear,
> And Sport leap'd up, and seized his beechen spear.

The remark I have just made will apply to the whole of this admirable group, than which a finer or more correct and accordant was never offered to the world. The passion of CHEERFULNESS gives, indeed, a specific expression and character to the countenance that sufficiently identifies it to the beholder, and is sufficiently capable of being seized and fixed by the painter; but it is not calculated for poetry, and the only feature Mr. Collins has copied into his description is that of a *healthy hue.* But he has admirably atoned for this poverty of his art by the picturesque scenery and associates with which he has surrounded her, and in which the province of poetry has an inexhaustible mine of wealth; and as much exceeds that of painting as painting exceeds poetry in the delineation of specific features and attitudes. Cheerfulness, though not distinguishable by the features of her person, is sufficiently made known to us by the company she keeps, by her attire, her manner, and her accoutrements.

One of the finest pictures and sweetest groupings of this allegorical kind to be met with in our own language, is contained in the following verses of Dr. Darwin's ode to May in his Botanic Garden. They are worthy of Anacreon or Pindar.

> Born in yon blaze of orient sky,
> Sweet MAY, thy radiant form unfold;
> Unclose thy blue, voluptuous eye,
> And wave thy shadowy locks of gold.
> For thee the fragrant zephyrs blow;
> For thee descends the sunny shower;
> The rills in softer murmurs flow,
> And brighter blossoms gem the bower,
> Light Graces, dress'd in flowery wreaths,
> And tip-toe joys their hands combine;
> While Love the fond contagion breathes,
> And, laughing, dances round thy shrine.

The subject is a pleasing one; but it swells before me to infinity, and I must drop it. In the lecture for next week, we shall enter upon the doctrine of physiognomy, or the permanent influence of the mind upon the exterior of the body.

LECTURE XIII.

ON PHYSIOGNOMY AND CRANIOGNOMY, OR THE EXPRESSION OF THE TEMPER AND TALENTS.

The ingenuity of man is never satisfied with research. In tracing out the disposition of the mind by the variable features of the face, it has been discovered that this last, though a general criterion, is not always an infallible sign. It does not in every instance, it is said, disclose even the present and acting emotion; for, in some persons, the symbols are naturally slight and evanescent; while in others, from a long and skilful course of hypocrisy and dissimulation, they are repressed, or even fraudulently exchanged for symbols, representative of affections which have no real existence. But still less do they manifest the fixed and permanent propensity of the mind, which is ever pursuing its specific drift, whatever be the transition of the passions or of the features from one character to another. And it has hence been inquired whether there may not be some soberer and less variable index by which the natural bent and tendency of the mind may be detected; a something that no art can imitate, no dissimulation conceal, enwoven in the toughest and hardest, as well as in the softer and more flexible parts of the body—in the very tissue and figure of the bones; and consequently which

> Grows with our growth, and strengthens with our strength.

From such inquiries has arisen the study, for it can scarcely be called the science, of PHYSIOGNOMY,—*Temper indication*, or *Temper-dialling*,—for such is the meaning of physiognomy, when strictly translated. It is a figurative term, which supposes the body to be a dial-plate on which the habitual turn or bearing of the mind is shadowed by means of the index or gnomon of some fixed and prominent external distinction, which retains its power and purpose amidst all the fleeting changes of the passions, and the mask of made-up smiles and serenity.

This study is of early date, and in its descent to our own day, has met with a perpetual alternation of evil report and good report, in proportion as it has acquired the favouritism or encountered the rejection of public opinion. Aristotle appears to have been the first philosopher who attempted to reduce it to any thing like a scientific pursuit, and to fix it upon any thing like permanent and undeniable principles. His definition of it is excellent. "It is the science," says he, "by which the dispositions of mankind are discoverable by the features of the body, and especially by those of the countenance." And in the development of this pursuit, he advanced it as a leading doctrine, that a peculiar form of body is invariably accompanied by a peculiar disposition of mind; that a human intellect is never found in the corporeal form of a beast; and that the mind and body exercise a reciprocal influence over each other: referring us for examples of the former to delirium and intoxication, in which the mental follows upon the corporeal derangement; and for examples of the latter, to the passions of fear and joy, in which the body universally displays the affections of the mind.

As the result of this principle and illustration, he argues, and no modern writer upon the subject has ever argued more clearly, that whenever among mankind a certain bodily character appears, which by prior experience and observation has been found uniformly accompanied by a certain mental disposition, we have a right to infer that it is necessarily connected with it ; and we may fairly and legitimately ascribe it to the individual that exhibits such character. And, pursuing this line of application, he tells us further, that our observations may be drawn from other animals as well as from men ; for, as a lion possesses one bodily form and mental character, and a hare another, the corporeal characteristics of the lion, such as strong hair, deep voice, large extremities, when discernible in a human being, cannot fail to raise in the mind an idea of the strength and courage of that noble animal; while the slender limbs, soft down, and other features of the hare, whenever visible or approximated among mankind, betray the mental character of that pusillanimous quadruped.

It is impossible to refuse our assent to sentiments so just and obvious ; and to this extent almost every one is a physiognomist by nature; for no man can walk the streets without noticing, in the first place, a marked and striking difference between one face and another face, one form and another form ; and, in the second place, without ascribing, in consequence of such difference, the possession of vigour to one person that passes by, wisdom to a second, magnanimity to a third, folly to a fourth, debility to a fifth, and meanness to a sixth.

Physiognomy, therefore, as to its general principles, has perhaps never been altogether neglected ; it seems in almost every age to have influenced men's opinion and conduct in first associating with strangers ; and has not unfrequently excited a favourable or an unfavourable prepossession before a word has been spoken or an action performed. As a science, though an imperfect one, it was pursued upon the general doctrines of Aristotle, among the Greeks and Romans, till the downfal of all the sciences upon the eruption of the northern barbarians into Europe, towards the close of the fifth century ; and was for a long time so systematically cultivated at Rome, that Cicero was in the habit of publicly availing himself of its force whenever, by employing it so as to excite contempt or hatred, it could be turned to the advantage of his client ; of which we have striking examples in his orations against Piso, and in favour of Roscius ; while we learn from Suetonius, that the emperor Titus engaged a professed physiognomist, of the name of Narcissus, to examine the features of Britannicus as to his character and chance of success in his claims upon the empire against himself; who, it appears, gave an opinion in favour of Titus, and declared, and according to the event, declared truly, that Brittanicus would never live to assume the imperial purple.

In this curious fact of history we find Physiognomy united at an early period of the Roman empire, with magic or judicial astrology ; and we also find, that upon its revival, on the general resurrection of science, about the middle of the fifteenth century, one of its first and most unfortunate occurrences was a connexion of the same kind ; from which it only separated to form other and successive alliances with metaphysical theology, alchemy, the doctrine of signatures and sympathies, and the theosophy of the Mystics and Rosicrucians. So that it again fell into contempt with the most liberal and enlightened part of mankind : who, however, did not give themselves the trouble to sift the wheat from the chaff. And though occasionally started afresh in literary journals, and other publications of considerable merit and authority, as, for example, by Dr. Gwyther and Dr. Parsons in our Philosophical Transactions ; by Pernetti and Le Cat, in the Transactions of the Berlin Academy ; and in the separate writings of Lancisi, Haller, and Buffon ; it was not till the appearance of the elegant and popular work of M. Lavater, the well-known Dean of Zurich, that physiognomy was again able to establish itself as a scientific pursuit in the good opinion of mankind.

The two grand objects of M. Lavater were to clear physiognomy of its mystical and other adventitious connexions, and to advance it to the rank of an exact and demonstrable science. The first of these was as judicious as the second was absurd : for he himself was at the time in possession of nothing more than a certain number of detached facts or fragments, which he did not venture to communicate to the world in any higher form than that of essays. His work is chiefly distinguished by a spirit of analysis, and at times of anatomy, to which no other work on the subject had hitherto pretended. Instead of generalizing the human form, and taking the features by the group, as was the case with Aristotle, and is the case with mankind at large, he aimed at separating the features from each other, and endeavoured to assign to each its peculiar bearing. And, fully believing that the general character of the mental disposition runs with an uniform and uninterrupted harmony through every feature and every organ, he frequently trusted to a single feature or a single organ for its developement. In doing which, he usually selected such as were least flexible, and by the mass of mankind least suspected ; as the form of the bones, particularly those of the head or face ; the shape of the ears, hands, feet, or even of the nails ; and he hereby endeavoured to baffle all dissimulation, and to avoid confounding the permanent temper with those occasional flights of passion by which the flexible features are disturbed and varied.

We have not time to follow up M. Lavater's hypothesis into these points of detail, nor would it be altogether worth our while if we had. The author was a learned and most excellent man, but at the same time a man of a warm and enthusiastic imagination ; and, notwithstanding that his remarks are in many respects precise, and his distinctions acute, and afford evident proof of their being the result of actual observations : and notwithstanding, moreover, that they are richly illustrated, after the laudable example of Baptista Porta, by expressive and elegant engravings—the declamatory tenour of his style, the singularity and extravagance of many of his opinions, his peremptory and decisive tone upon the most vague and disputable topics, his puffing up trifles into matters of magnitude, and the absurd extremes to which he pushed his hypothesis, so as to make it embrace and exemplify the face and features of all nature as well as those of man and the higher ranks of quadrupeds ; these and various other sproutings of the warm and luxuriant fancy I have just referred to, prevented his work from obtaining more than a transient popularity ; and it sunk beneath the attacks of M. Formey and other Continental writers, who laboured, and some of them perhaps disingenuously, to point out its defects and extravagancies.

Perhaps one of the most whimsical of M. Lavater's opinions is, that no person can make a good physiognomist unless he is a well-proportioned and handsome man ; a position which seems to be altogether at variance with his own progress in the study, for the Dean of Zurich had few pretensions to such a figure. Another singularity of opinion was that of his extending his physiognomic characters to the peculiarity of the handwriting; and in this instance reviving the reveries of many of the ancient mystics, who pretended to confide in the same mark; whilst, by interweaving into the body of this science a belief in apparitions, and this, too, upon very peculiar and fanciful principles, he has indirectly connected it with the dark and exploded study of divination, from which it was one of his first and most prominent objects to separate it.

I will only farther observe, that in the wide extent to which he carried this favourite and fascinating science of his heart, he describes the whole material world as subject to its dominion; amuses us with a developement of the propensities, partialities, and ruling passions, not only of men and quadrupeds, but of birds, fishes, reptiles, and insects, from the unequivocal language of their external expression; and makes the reputable class of tradesmen, probably without their knowledge, the deepest physiognomists in the world; for the trader, says he, when in the act of dealing, not only at once decides that his customer has an honest look, a pleasing or forbidding countenance, and trusts or forbears to trust him accordingly; but determines by its colour, its fineness, its exterior, the physiognomy of every article of traffic. How far the former part of this last remark may apply to M. Lavater's own countrymen, the honest and enlightened traders of Zurich, I will not pretend to say; but it is highly probable that there are some before me who have not always felt themselves able to read the characters of the countenance quite so well as is here supposed of them, and to whom a few additional lessons from the Zurich counting-house, or the Zurich professor, might have been every now and then of no small service in the transactions of buying and selling; and have saved them, in various instances, from bad debts and impositions.

Having pointed out these defects, it becomes me to observe, that, with all its blemishes, M. Lavater's Essays form the best and fullest book on the subject we at present possess. To say nothing of its language, which, though far too florid, is animated, and often elegant, it is a rich repository of isolated facts, shrewd remarks, and ingenious suggestions; and with less fancy, and more judgment, would have been, and must have been, the favourite text-book of every physiologist in this branch of natural philosophy. Nor, even as it is, can it ever be neglected by any who is desirous of establishing physiognomy upon a permanent and sober basis; and of analyzing the causes, and determining the real principles, upon which every one pretends to judge, whether rightly or wrongly, of the internal qualities of the mind, by the external features of the body; and consequently, as in the case of astronomy, gives proof that the study is founded in nature, although its specific laws have not had the good fortune, like those of gravitation, to be systematically sought out and exemplified.

It is from this last circumstance, in connexion with M. Lavater's desultory and erratic mode of handling his subject, that other philosophers have been induced to abandon altogether the common ground of the general form and features, upon which mankind in all ages, whether learned or unlearned, have hitherto reasoned, and to inquire whether there may not be some less sensible and obvious, but at the same time more fixed and scientific, more exact and immediate index in some part of the human figure, which may infallibly direct us to the same ends. No minister has hence devised more schemes for taxation, no insurance-broker more modifications for a lottery, than this general research has given rise to—this philosophical rage

T' expatiate free o'er all this scene of man,
This mighty maze, but not without a plan;
This wild where weeds and flowers promiscuous shoot;
This garden, tempting with forbidden fruit.

Of all these attempts, however, there is but one that is in any degree worthy of notice, or that has acquired any considerable degree even of transitory popularity; and this is the hypothesis of Dr. Gall of Jena, who has been greatly indebted to his friend Dr. Spurzheim for a popular diffusion of his doctrine over most parts of Europe. This learned philosopher, being determined to deviate as far as possible from the beaten path, left the face or front of the head to the rest of the world, and took the crown and back part for his own use. He conceived, first, that as all the faculties of the mind are limited to the common sensory or organ of the brain, nature, like a skilful general, instead of confounding every part with every part, and every faculty with every faculty, has marshalled this important organ into a definite number of divisions, and has given to every faculty the command of a separate post. He conceived, secondly, as the general mass of the brain lies immediately under the cranium or scull-bone, and is impacted into its cavity with the utmost exactness, that if any one or more of the aforesaid faculties, or, which is the same thing, any one or more of the aforesaid divisions of the brain allotted to their control, should be peculiarly forward and active, such divisions must necessarily grow more abundant, and give some external token of such abundance by a constant pressure against those particular portions of the cranium under which they are immediately seated, and which, by uninterrupted perseverance, and especially in infancy and early life, when the bones of the cranium yield or are absorbed easily, they must elevate and render more prominent than any other part.* And, thirdly, he conceived, that every man having some faculty or other more marked or active than the rest, or, in his own phraseology, more sensibly manifested, from which, indeed, his peculiar disposition or propensity takes its cast, must necessarily also have some peculiar prominence, some characteristic bump or embossment, by which his head is distinguishable from all others, or at least from all others of a different temper, or attracted by different objects of pursuit; and that nothing more is necessary than to determine the respective regions of the different faculties which belong to the brain, in order to determine at the same time, from the external bump or prominence, the internal propensity of character.

These premises being in his own mind satisfactorily established, Dr. Gall next sets to work with a view of deciding the relative parts of the brain possessed by the different faculties or their respective sentient organs. And having settled this important point to his own thorough conviction, he immediately made a map of the outside of the head, divided it into corresponding regions, and was able, in his own opinion, to indicate to a demonstration the characteristic temper or tendency of every man presented to him by a mere glance of the eye, or a mere touch of the finger. For, in the language of Dr. Spurzheim, "in order to distinguish the developement of the organs, it is not always necessary to touch the head; in many cases the eye is sufficient."†

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* "It seems to me, that at least a great part of every organ lies at the surface; and that if the part of any organ be well developed, the whole participates of this developement."—Spurzheim, Physiognom. System, p. 264. In p. 240, he admits, however, that "the organs are not confined to the surface."

† Physiog. Syst. p. 261.

Let me not, however, do injustice to the talents of the inventor of this hypothesis. For, he is not only possessed of a lively ingenuity and fancy, as his speculation, thus far unfolded, must suggest to every one, but he is also a man of learning, and of patient and indefatigable research. And such is the plausibility of his scheme, that he has contrived to enlist under his banners not a few philosophers and physiologists of considerable eminence and merit, among whom I may especially mention Dr. Bojames, who was one of the first to publish an account of this singular line of study to the world, and, as already observed, Dr. Spurzheim, who is at this moment lecturing upon the subject in this metropolis.*

The allotments of the different parts of the brain, and the consequent laying down of the outside of the cranium into a superficial map of mental qualities or sensations, was a work of great patience and investigation. To accomplish it, hundreds, perhaps thousands of human sculls, of known characters and propensities, were examined, and their peculiar impressions, whether prominences or indentations, were noticed and arranged. These were afterwards compared with the respective tempers and inclinations of the particular subjects while alive; and the whole tried by the craniognomy, as it was called, of other animals celebrated, in common language, for the acuteness of their respective instincts; but, in the language of Dr. Gall, for the acuteness of their predominant organs of sensation; in whose sculls correspondent symbols were observed, or supposed to be observed.

The whole was hence reduced to one regular system; the brain was found to consist of thirty-three separate parts or chambers, and consequently the superincumbent cranium was divided into as many sections, from the lowest part of the back of the head, over the crown, to the orbits of the eyes. It is not my intention to dwell upon any of these chambers, or superficial sections. To enumerate them, with a few explanatory hints, is all we can find space for; and even this, I am afraid, cannot be done without an occasional verification of the poet's remark, that there may be situations in which, although

To laugh is want of goodliness and grace,
Yet to be grave exceeds all power of face.

The following is the classification of the different mental powers of the brain, and the order in which they lie, according to the table of Dr. Bojames, one of Dr. Gall's earliest and most assiduous pupils, commencing, as I have already observed, at the lowest part of the back of the head. I. Organ of tenacity of life. II. Of self-preservation. III. Selection of food. IV. Organ of the external senses. V. Instinctive sexual union. VI. Organ of the mutual love of parents and their offspring. VII. Organ of friendship. VIII. Organ of courage. IX. Organ of murder or assassination. X. Of cunning. XI. Circumspection. XII. Vanity, conceit, or self-love. XIII. Love of glory. XIV. Love of truth. XV. General memory, otherwise called sense of places and things. XVI. Painting, or sense of colours. XVII. Sense of numbers. XVIII. Musical sense. XIX. Sense for mechanics. XX. Verbal memory. XXI. Sense for languages. XXII. Memory of persons. XXIII. Liberality. XXIV. Talent for satire. XXV. Talent for comparing things. XXVI. Metaphysical talent. XXVII. Talent for observation. XXVIII. Goodness. XXIX. Theatrical talent. XXX. Theosophy. XXXI. Perseverance. The remaining two to complete the thirty-three being, at the time Dr. Bojames wrote, unappropriated; a sort of terra incognita, which the master of the system had not yet sufficiently explored, but one of which he subsequently discovered to be, the natural organ for theft or stealing.* A few alterations have since been made in the general arrangement, both by Dr. Gall himself and by several of his pupils, especially by Dr. Spurzheim, but of no essential moment in a cursory survey.†

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* This lecture was delivered at the time of Dr. Spurzheim's first visit to England, for the purpose of illustrating his hypothesis, which has certainly possessed every advantage of which it is susceptible from his exertion and talents. Yet it is well known, that scarcely an individual among the more distinguished anatomists or physiologists of our own country have been led to adopt his views. To the discrepancy of Sir Everard Home's conceptions the author will have occasion to advert in a subsequent note. The following is the opinion of Mr. Charles Bell in his very excellent paper on the nerves of the orbit of the eye, as contained in the Philosophical Transactions for 1823, p. 306. "But the most extravagant departure from all the legitimate modes of reasoning, though still under the colour of anatomical investigation, is the system of Dr. Gall. It is sufficient to say, that, without comprehending the grand divisions of the nervous system; without a notion of the distinct properties of the individual nerves; or, without having made any distinction of the columns of the spinal marrow; without even having ascertained the difference of cerebrum and cerebellum, Gall proceeded to describe the brain as composed of many particular and independent organs, and to assign to each the residence of some special faculty."

It is not a little singular that men should be supposed to be provided by nature with express organs for the cultivation of murder and theft; terms which are softened down by Dr. Spurzheim, in his own catalogue, into the words DESTRUCTIVENESS and COVETISENESS; but which, in the body of his works, he treats of under the common and more intelligible names.

The proofs of these organs have been laboured with peculiar force, and not without some apology for their formation. "Our opponents," says Dr. Spurzheim, "maintain that such a doctrine is both ridiculous and dangerous; ridiculous because nature could not produce any faculty absolutely hurtful to man; dangerous, because it would permit what is punished as a crime by the laws. Gall was accustomed to answer, nobody can deny the facts which prove that theft exists; and as it exists, it is *not* against the will of the Creator; and there are very few persons who have never stolen any thing. The organ is, moreover, very considerable in inveterate thieves."‡

The morality here offered is certainly not of the purest kind. It directly avows that the Creator has given an express sanction and countenance to robbery and murder by the construction both of the body and mind; by natural organs and propensities for the commission of these crimes. It cannot, indeed, be denied, that God has *willed* them, for nothing can take place contrary to his will. But there is a little logical nicety or special pleading in this assertion, and it is necessary to recall to our recollection what I endeavoured to prove in a late lecture,§ that the WILL and the DE-

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* The Physiognomonical System of Drs. Gall and Spurzheim, &c. p. 280. 8vo. Lond. 1815.

† The table, as modified by Dr. Spurzheim, gives us the following arrangement. 1. Order of amativeness. 2. Philoprogenitiveness. 3. Inhabitiveness. 4 Adhesiveness. 5. Combativeness. 6. Destructiveness. 7. Constructiveness. 8. Covetiseness. 9. Secretiveness. 10. Self-love. 11. Approbation. 12. Cautiousness. 13. Benevolence. 14. Veneration. 15. Hope. 16. Ideality. 17. Consciousness. 18. Firmness. 19. Individuality. 20. Form. 21. Size. 22. Weight. 23. Colour. 24. Space. 25. Order. 26. Time. 27. Number. 28. Tune. 29. Language. 30. Comparison. 31. Causality. 32. Wit. 33. Imitation.

‡ Physiolog. System, &c. p. 398. 8vo. Lond. 1815.

§ Ser. III. Lect. VIII.

SIRE are two distinct attributes; though in ordinary language confounded and used synonymously. It is true, then, that God has willed robbery and murder; but it is equally true that he has not desired them; it is equally true that he has most positively expressed his desire upon the subject, and has forbidden them under the severest threats. Our duty, therefore, is to attend to the prohibition: our moral conduct is to be collected from his desire, and not from his will, excepting where the word will is employed in its popular sense, and synonymously with desire. The professors of this new physiognomy, however, having thus advanced their peculiar doctrine upon the subject before us, endeavour to illustrate it by copious examples of persons, who, from being endowed with the stealing bump and stealing organ, had a peculiar and irresistible propensity to rob and plunder. Among these, Dr. Spurzheim introduces various characters, whom we should not very readily have suspected to belong to a gang of thieves. He tells us of a chaplain in a Prussian regiment, a man of great intelligence and ability, who *could not avoid* (for these are his words) stealing handkerchiefs from the officers at the parade. He informs us, that Victor Amadeus I., king of Sardinia, took every where objects of little importance; and, what will still more astonish the audience before me, that M. Saurin, the Genevese pastor, though acquainted with the best principles of reason and religion, was overcome continually by this propensity to steal. He has given us, however, no authority for this last assertion; and no such calumny should be believed without full proof.

There is, indeed, an endeavour on the part of Dr. Spurzheim, though I do not find he is supported by any of his colleagues, to let down, in some degree, this charge against nature and the Author of nature, by telling us, that though the organs exist that bear these names, and produce a specific propensity, they do not urge on the individual to the actual commission of great crimes of this kind till they are very largely developed, and the developement has not been controlled by other faculties, which he seems to intimate may have an influence upon them. "These functions," says he, "are ABUSES, which result from the highest degree of activity of certain organs, which are not directed by other faculties." Now, in the first place, it should seem, by his own examples, that other faculties have very little control over the master-organ or propensity at any time: for, even admitting the truth of his extraordinary anecdote concerning M. de Saurin, there can be no doubt that all his faculties of morality and religion were habitually at work in repugnancy to his faculty of thieving, and yet, according to Dr. Spurzheim, to no purpose. But, secondly, the learned writer exhibits a strange inconsistency, in regarding the full developement of a function "as the abuse of a function." The function is a natural power; its growth is a natural power; and hence its full developement, or "the highest activity of the organ," instead of being an ABUSE of such organ or function, ought only to be regarded as its NATURAL PERFECTION. And, lastly, let the matter be how it may, the man, even in his moral character, is passive under every stage of its progress; or, in the more tangible and explicit language of M. Magendie, "Il est impossible de se changer à cet égard. NOUS RESTONS TELS QUE LA NATURE NOUS A FAITS."*

Not a few persons will, perhaps, be surprised at finding, that nature has likewise kindly provided us with an impulsory organ for theatrical amusements; and that she thus seems satisfactorily to have settled the lawfulness and expediency, so eloquently and forcibly controverted by the learned Bossuet, about a century ago, of frequenting the theatres and encouraging the drama.

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* Prècis Elementaire, 2 toms. 8vo. Paris, 1816, 1817.

The relative position, moreover, of the different organs I have thus far noticed, is an object of no small curiosity. In the map of the scull those of murder and thieving lie immediately next to those of friendship and courage; while the region for comedies and farces lies directly between the boundaries of moral goodness and theosophy or religion: concerning which last Dr. Bojames expresses himself as follows: "The organ of theosophy occupies the most elevated part of the os frontis. All the portraits of saints which have been preserved from former ages afford very instructive examples; and, if this character be wanting in any one of them, it will certainly be destitute of expression. It is excessively developed in *religious fanatics, and men who have become recluse through superstition* and religious motives. It is the seat of this organ," continues he, with a subtlety of reasoning worthy of Aquinas, "which, according to Dr. Gall, has induced men to consider their gods as above them, or in a more elevated part of the heavens; for otherwise," he adds, "there is no more reason for supposing that God exists above the world than below it."

The theological world cannot but be infinitely obliged to Dr. Gall and Dr. Bojames for this new and unanswerable proof of the divine existence. God, it seems, exists, and must exist, because many men have a bump upon the crown of the head, which these philosophers choose to call a religious pump. Dr. Gall, indeed, contends openly that this organ "is THE MOST EVIDENT PROOF OF THE EXISTENCE OF GOD." I quote the words of his learned colleague Dr. Spurzheim,* who is perpetually using the word proof in the vaguest manner possible, though a manner common to the school. "In general," says Gall, in continuation, "every other faculty of man and animals has an object which it may accomplish. Can it, then, be probable that God does not exist, while there is an organ of religion? HENCE GOD EXISTS."

The next benefit we obtain from the discovery of this important organ and embossment is, that it settles the long-contested question concerning the nature and extent of the divine residence—the locality or ubiquity of the Deity. God, it seems, must exist *above* us, for the religious bump is on the top of the scull; and he cannot exist any where else than above us, because there is no religious bump in any other direction.

The noble catholicism, moreover, of this incontrovertible proof cannot fail to be matter of the highest gratification; a catholicism that puts that of Christianity to the blush, at the thought of its own narrowness; for the demonstration before us extends equally to all gods, and to all religions: it is *found*, we are told, in the portraits of *saints;* but it is most *highly developed* in religious *fanatics*, and in men who have become recluse through *superstition*. Surely if Dr. Gall or Dr. Bojames had looked a little more closely, they might have discovered that the still vacant region (vacant, at least, at that time) is the seat of absurdity or folly, and that some heads they are acquainted with are not without its mental manifestation. There is not quite so much, perhaps, to condemn in Dr. Spurzheim's remarks upon the same organ; for this most able advocate for the school thinks more clearly, and writes more cautiously in the main; but he also very closely touches, at times, upon the region of absurdity, if he do not absolutely fall into its boundary; and, in uniting the name of our Saviour with that of Jupiter, seems to show, that the same cast of religion, as well as of moral philosophy, is common to the school. His remarks are as follows: "The pictures of the saints show the very configuration of those pious men whom Gall had first observed. It is also in this respect remarkable that the head of Christ is always represented as very elevated. *Have we the real picture of Christ?* Have artists given to the head of Christ a configuration which they have observed in religious persons, or have *they composed this figure from internal inspiration?* Has the *same sentiment* among *modern* artists given to Christ an elevation of head, as among the ancient it conferred a prominence of forehead upon JUPITER? At all events, the shape of the head of Christ contributes to PROVE this organization."*

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* Physiolog. Syst. ut supr. p. 414.

Now in this very singular passage there are three propositions, concerning which, it is difficult to say which is to be admired most; a *proof* deduced from queries, which the author is incapable of answering; the idea that our Saviour possibly sat for his picture; and the idea that modern artists are possibly *inspired* when they paint his image from their own conceptions. I must leave the reader to make his own comments (for I dare not trust myself on the subject) concerning the edifying resemblance which is here pointed out between the head of the Saviour of the world and that of the JUPITER of the Greek poets; and the unity of SENTIMENT which has ever, it seems, prevailed between ancient and modern artists, when engaged in studying these *sacred* models.†

In seriousness and sobriety, however, it is not a little extraordinary, not only that folly and absurdity, but that wisdom, hypocrisy, gluttony, drunkenness, sensuality, mirth, melancholy, and some dozens of other powers and faculties of the most common kind, should have no chamber allotted to them, no protuberance or manifestation, in the hypothesis before us. During an interview I had some months ago with Dr. Spurzheim, I started this difficulty for explanation; but his reply was at least not satisfactory to myself. It may be sufficient to observe, as a single example, that for the organ of gluttony he referred us to the stomach; but this is rather to evade than to meet the difficulty. The stomach is unquestionably the organ of hunger; as the eye of sight, and the ear of hearing; but if the painter, who derives a pleasure of a peculiar nature from the eye, as in the case of colours; or the musician, who derives a pleasure of a peculiar nature from the ear, as in the case of sounds, have an express chamber in the brain, by which such peculiar pleasure is alone excited, and on which it alone depends, so ought the glutton, who derives a pleasure of a peculiar nature from the stomach. While, if there be no such cerebral region or chamber in the brain, and, consequently, no external developement or manifestation of gluttony, or any of the other feelings or sentiments I have just glanced at, the system itself, even admitting its general truth, must be so far imperfect and unavailing: it must dwindle into a half science, and be more liable to lead us astray than aright.

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* Physiolog. Syst. p. 412.

† It is always amusing, and sometimes instructive, to trace the learned rovings of different philosophical imaginations, when indulging in a like pursuit; to mark the point from which they set out, and follow up the parallelism or divergency of their respective courses, when aiming at a common goal. Sir Everard Home, whom every one will allow to be as deeply versed in the internal structure and the external mapping of the brain as either Dr. Gall or Dr. Spurzheim, seems also, from a late article in the Philosophical Transactions, (1821, p. 31,) to have felt a tendency to the study of phrenology. But from the only two regions he appears yet to have visited in his new voyage of discovery, his bearings are likely to be in every respect widely different from those of the German navigators, and calculated to lead to very different results. These regions are the supposed natural seats of MEMORY and CONCUPISCENCE. While Dr. Gall and Dr. Spurzheim fix the first of these, as far as they are able to ascertain its dominion, between the nose and the forehead, (Spurz. p. 427.) Sir Everard has had to pursue his course into a far higher latitude, and did not reach it till he arrived at the vertex of the scull, that very region which the German craniognomists have already taken possession of for the faculty of *religious veneration*, as just noticed in the text: at the same time, that while these skilful explorers have decidedly fixed the organ of CONCUPISCENCE at the nape of the neck, the *ultima Thule*, or lowermost extremity of the cranial sphere, (p. 344,) Sir Everard has found it at its sinciput or highest part of the forehead; bordering, indeed, where we should little have expected it, upon the region of memory or religious veneration, according to Dr. Gall's hypothesis.

There is also another powerful objection, which I will beg leave to state, as I stated it at the same time to the learned lecturer I have just alluded to, though, so far as appeared to myself, without a successful solution. It is this. The strictly obvious or natural divisions of the brain are but three; for we meet with three, and only three distinct masses,—the cerebrum or brain properly so called, the cerebel or little brain, and the oblongated marrow. The first, as we have formerly observed, constitutes the largest and uppermost part; the second lies below and behind; the third level with the second, and in front of it; it appears to be a projection issuing equally from the two other parts, and gives birth to the spinal marrow, which is thus proved to be a continuation of the brain extended through the whole chain of the spine or back-bone.

Now as the brain consists naturally of three, and only three distinct parts, it may be allowable and pertinent to suppose that each of these parts is allotted to some distinct purpose; as, for example, that of forming the seat of thinking, or of the soul; the seat of the local senses of sight, sound, taste, and smell; and the seat of that general feeling which is diffused all over the body; but as the nice hand of the anatomist has confounded even so rational a speculation as this, by proving that many of the nerves productive of different functions originate in the same division of the brain, while others, limited to a single function, originate in different divisions of it;* as it has hereby shown that we know nothing of the reason of this palpable conformation, nor the respective share which each of these grand divisions takes in producing the general effect,—how fanciful and presumptuous must it be to partition each or any one of these divisions into a number of imaginary regions, and to guess, for after all, it comes to nothing more, at the respective duties allotted to these boundaries of our own conceit!

But the most serious, or perhaps I should rather say the most *ludicrous*, and as it appears to me the most fatal objection to this hypothesis, is the extraordinary fact that the different professors of it cannot agree in dividing the brain, or in mapping the scull-bone; some of them telling us that a bump or protuberance in a given situation imports one faculty, and others, that it imports another faculty; while one or two of them have, at different times, assigned different faculties or manifestations to the same bump. The organ which Dr. Gall at first called that of courage, he afterwards denominated that of quarrelsomeness, and still later that of self-defence. Now the qualities of self-defence and of quarrelsomeness are as opposite as those of light and darkness; while that of courage is distinct from both of them. So the organ of the theatrical talent he afterwards detected to be, and consequently denominated it, the organ of poetry; and Dr. Spurzheim has since found out that even this name, to adopt his own words, "does not indicate the essential faculty of the organ,"* which is rather that of fancy or imagination; and he has hence called it the organ of ideality. Gall asserts that there is no separate organ for hope; Spurzheim contends that there is, and that its protuberance lies near the crown of the head. Gall asserts that nature has furnished us with one region or propensity for assassination or murder, and two for thieving or stealing—daring and audacious stealing, and cunning circumspect stealing. Spurzheim is more moderate: he contends that nature has given us but one for each, and maintains that the second stealing bump of Gall manifests nothing more than a general propensity to reserve or secrecy.† Gall makes the same organ which impels various animals, as the chamois or wild goat, to prefer lofty situations, indicative of pride or self-love in man. This, in Bojames's table, is denominated the region of vanity or conceit; but as such a term will not cover the idea of fondness for elevated situations, Dr. Gall has since called it the region of haughtiness. Now this would do well enough for a conundrum-maker:—why is a wild goat like a proud man? because it is fond of what is haughty or lofty;—but such quirks and punnings are altogether unworthy the dignity of serious philosophy. Dr. Spurzheim, indeed, has felt it so; but then he has still further confounded the hypothesis, by honestly confessing, in the first place, that he does not know where the organ that impels us to prefer one place rather than another resides, though he apprehends there is such an organ; while he positively affirms that the bump or protuberance of self-love or pride lies in another part of the head than that affirmed by his colleague and master.

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* See Stud. of Med. vol. iv. p. 6. 2d edit.

"Who shall decide when doctors disagree."

A thousand other objections and inconsistencies, each of them perhaps fatal to the hypothesis, might be pointed out, if we had time. I may especially ask, since murder and thieving have express organs in the brain, how it comes to pass, that lying, and swearing, and backbiting have not equal organs? If the mechanic and the painter have organs that specifically identify them, why has not the haberdasher and the tailor? the latter more especially, since, as it has lately been attempted to be proved, by a learned writer on the subject, that the calling of the tailor is the oldest of all professions whatever; "a calling," says he, "that commenced immediately after the fall: for it was then that mankind sewed fig-leaves together, and made themselves clothes."

Even upon the subject of the religious bump, upon which I have said so much already, the professors of the new school cannot altogether agree; for while Dr. Gall and Dr. Bojames affirm that this protuberance on the top of the head indicates the existence of a God, and is the most cogent proof mankind possess of such existence, Dr. Spurzheim contends that it is no proof whatever—that his friends have mistaken the quality—and that it indicates neither religion nor morality; both which, it seems, in the opinion of this enlightened philosopher, have nothing to do with each other: for, "one man," says Dr. Spurzheim, "may be religious without being just, and another may be just without being religious."‡ Dr.

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* Physiolog. Syst. p. 417. † Ibid. pp. 400. 402. ‡ Ibid. p. 415.

Spurzheim gives to this protuberance, therefore, a different and a far ampler scope, so as to cover, as all his names do, fifty or a hundred qualities at the same time. He calls it, indeed, the organ of veneration, which at first sight appears to have an approach to the name given it by Gall and Bojames; but then he especially tells us, "that this faculty does not determine the object to be venerated, nor the manner of venerating; and that it equally includes the veneration of God, of saints, of persons, or any thing else, however mean or contemptible." Yet this is the organ which Dr. Spurzheim has supposed to have been peculiarly developed in the head of the Saviour. As some amends, however, for his philosophical apostacy upon this point, he makes Dr. Gall's origin of *moral* goodness, in his explanation, the organ of *Christian* charity,* for so he expresses himself; introduces a new organ, which Gall will not allow, and a bump which Gall cannot find out, to indicate religious hope and faith, and which he places next to Gall's religious bump; at the same time totally defeating the value of his *amende honorable* by adding, that this organ of faith and hope, "in persons ENDOWED with it in a higher degree, manifests credulity."†

Such, then, are a few of the inconsistencies of the new hypothesis, and the discordances of its different professors with each other.

But it may be replied, that there is no reasoning against facts; that the gentlemen I allude to are men of learning and character; and that they have actually determined the moral propensities of a multitude of persons, by a reference to the rules of their own art. I admit the learning and character of these gentlemen, and most freely pay homage to them on this score; but these qualities, though a full security against voluntarily deceiving others, is no proof whatever against self deception.

There is no science, perhaps, among those professed formerly, and held in the highest estimation, which has fallen into more contempt than that of judicial astrology. Yet this, when it was in fashion, was for ages embraced by men of the greatest learning and talents, and of unblemished integrity: and who, in a thousand instances, foretold events that actually came to pass: and persuaded themselves that they foretold them by the rules of their own art. Such, to confine ourselves to times comparatively recent, were Baptista Porta, Cardan, and Kepler, of the sixteenth century: the first, the most distinguished scholar, and the two last the most distinguished mathematicians of their age; and such were the Abbé de Rancé, the celebrated founder of the monastery of La Trappe, and our own two learned countrymen and poets Cowley and Dryden, in the seventeenth century. And let the school before us, therefore, boast as much as they may upon this subject, we can bring far more numerous instances of individuals as honest, as successful, and incomparably more learned, who have devoted themselves to a science which is now utterly abandoned by every man in the possession of his senses. To talk, therefore, of the *occasional* success of the physiognomists before us, is to add not a barley corn to the scale in their favour; since right they must sometimes be, upon the common doctrine of chances and the very nature of things; right they may sometimes be, from the common physiognomy of the face: right they may still more frequently be, from the artful and sweeping amplitude of the reply which may be made to cover a variety of tempers or propensities at the same time; and necessarily and infallibly right they do not profess to be.

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* Physiolog. Syst. p. 416.

† Id. p. 416.

The whole, in truth, is founded on hypothesis: here it begins, and here it ends; hypothesis, too, unsettled and disputed, in many of its points, among themselves. And yet, planting their feet upon this tottering and unsteady ground, they are perpetually uttering the proud and lofty words *science*, *proof*, and *demonstration;* than which a more palpable or grosser abuse of terms can never be employed or conceived.

In few words, how grossly imperfect must be the range and condition of that science, which, upon their own showing, is capable of deciphering to us, that this man is a good musician; that a good painter; a third, a good linguist; a fourth, a good dramatist; a fifth, a good theologian; a sixth, a good murderer; and a seventh, a good thief; and that any or all these may at the same time be ambitious, or courageous, or conceited, or cunning; while, if you ask them whether they are good liars, good backbiters, or good swearers; whether they are inclined to gluttony or sensuality, to wisdom or folly, to sympathy or hypocrisy, to timidity or confidence, to mirth or to melancholy; characters, the one or the other of which apply to every one you meet with, whether abroad or at home, they are compelled to acknowledge that their physiognomy or craniognomy does not extend to any one of these qualities, and that nature has either forgotten to put them into the catalogue with which the head is covered, or has marked them so bunglingly and obscurely that they cannot read the writing.

LECTURE XIV.

ON THE LANGUAGE OF THE PASSIONS.

In an early lecture in the present series I observed that the passions, when called forth and operating, discover themselves by a double influence upon the organs of the body, the EXPRESSION OF THE FEATURES, and the CHARACTER OF THE LANGUAGE. The first we have already noticed; let the second serve as a subject for the lecture before us.

That the presence and operation of the passions give a peculiar style and animation to the language must have been observed by every one who has paid the slightest attention either to his own feelings, or to those of the world around him. The man who is in a state of calm and tranquillity will always have his ideas flow in a calm and tranquil current, and express them in an easy and uniform tenour. But let him be roused by some sudden and violent insult, or by some unexpected stroke of overwhelming joy or sorrow, and the tempest of his soul will give a corresponding tempest to his utterance. His speech, instead of being mild and uniform, will be vehement, energetic, exclamatory, and abrupt; his judgment will be borne down, his imagination ascendant; the face of nature will, in consequence, assume a new aspect, presenting a distorted, an unduly bright, or an unduly saddened picture, according to the nature of the predominant emotion; and the phraseology will partake of the colouring, and become proportionally figurative and fanciful.

This is not a sketch of any particular age or country, but of all ages and all countries; it is a sketch of mankind at large; and we draw from it these two conclusions: first, that the natural language of the passions is strong, ardent, and abrupt; or broken into short sentences or versicles; full of figure and imagination, and consequently possessing all the radical characters of poetry: and, secondly, that we may expect to meet with the boldest and most frequent use of this kind of language in those periods of every nation in which the passions have been most unrestrained and luxuriant, and therefore in their earliest and least cultivated state; for we have already seen, that in this state the most vehement and energetic passions are in perpetual play and activity.

Now the whole history of the world will confirm us in these two general corollaries; and it has hence been said, and in a restricted sense said truly, that the language of poetry is older than that of prose. Its principles are founded in nature, and in nature in her simplest and most unsophisticated state; and it is to these principles mankind uniformly recur, whenever hurried by a violent shock of feeling from the polished tameness and monotony of colloquial speech. It is then we return to exclamations, interrogations, broken sentences, bold and daring comparisons; and, whether we be indifferent to the world or not, succeed in interesting it in our fate and condition.

Where, among uncultivated tribes, the passions chiefly called into exercise have been of the pleasurable and sprightly kind, such as we have already seen are the natural result of warmth and beneficence of climate, of tranquil scenery, and an atmosphere perfumed by the rival odours of spontaneous blossoms and balsams, the rude burst of delight has assumed a more regular or measured character, and been uttered in the form of chant or brisk melody, with such corresponding attitudes or movements of the body as might best co-operate in proving the exuberant gayety of the heart. And hence music and dancing are nearly of as early origin as poetry: they were prompted by the same impulse, and had a direct tendency to heighten each other's power; while ingenuity soon taught the more dexterous of the tribes to imitate musical sounds by the invention of the simple instrument of pipes and rebecks. The Greek philosophers ingeniously and perhaps correctly ascribed the first carols of the human voice to an imitation of the wild notes of the birds; and the first idea of musical instruments to the occasional whispers of the breeze among beds of hollow reeds. Lucretius has expressed himself upon this subject with so much sweetness, that I lament the constraint I feel under of quoting him before a popular audience rather in a translation than in his native beauty and elegance; yet the following verses will, I presume, give a faint idea of the high merit of the original.

> And from the liquid warblings of the birds
> Learn'd they their first rude notes, ere music yet
> To the rapt ear had tuned the measured verse;
> And Zephyr, whispering through the hollow reeds,
> Taught the first swains the hollow reeds to sound;
> Whence woke they soon those tender trembling-tones
> Which the sweet pipe, when by the fingers press'd,
> Pours o'er the hills, the vales, the woodlands wild,
> Haunts of lone shepherds and the rural gods.
> Thus soothed they every care, with music thus
> Closed every meal, for rests the bosom then,
> And oft they threw them on the velvet grass,
> Near gliding streams, by shadowy trees o'er-arch'd,
> And, though no gold was theirs, found still the means
> To gladden life. But chief when genial Spring
> Led forth her laughing train, and the young year
> Painted the meads with roseate flowers profuse,—
> Then mirth, and wit, and wiles, and frolic, chief

Flow'd from the heart; for then the rustic muse
Warmest inspired them; then convivial sport
Taught round their heads, their shoulders, taught to twine
Foliage, and flowers, and garlands, richly dight;
To loose, innumerous time their limbs to move,
And beat with sturdy foot maternal earth;
While many a smile, and many a laughter loud
Told all was new, and wond'rous much esteem'd.
Thus wakeful lived they: cheating of its rest
The drowsy midnight; with the jocund dance
Mixing gay converse, madrigals, and strains,
Run o'er the reed with broad recumbent lip:
As, wakeful still, our revellers through the night
Lead on their defter dance to time precise,
Yet cull not costlier sweets, with all their art,
Than the rude offspring earth in woodlands bore."*

Nature is ever the same; and hence music, and dancing, and poetry, and impassioned language are to be found at this moment, in all their energy and irregular wildness, among the barbarians of North America, those of the Polynesian islands, and even the negro tribes of Africa; while not unfrequently we hear an equally daring and figurative diction, though of a very different kind, vented by the last in a state of Mexican or West Indian slavery, alternately mixed with terrible execrations on the heads of their cruel task-masters, and with the most piteous longings for freedom and their native land.

In like manner it existed, and was even cultivated with systematic attention, among the earliest savages of the hyperboreal snows, the Goths, Scythians, or Scandinavians; nor less so among the Celtic tribes of Gaul, Britain, and Ireland. The scalds of the former, and the bards or druids of the latter, were always held in the highest dignity and admiration; their persons were esteemed sacred; their rhapsodies were in measured flow, and had an enthusiastic effect in rousing their fellow-countrymen to arms, to religious rites, or funeral lamentations; in rehearsing the dangers they had encountered, and the victories they had gained; and in stimulating them to a contempt of torment and death under every shape, in the high career of heroic exploits, and the glory of living in the national hymns of future ages.

Such was the death-song of Regner Lodbrok, a Danish prince of the eighth century, and one of the most celebrated scalds of his day. It mischanced the warrior to fall into the hands of his enemies, by whom he was thrown into prison, and condemned to be destroyed by serpents. In this situation he solaced himself with rehearsing all the exploits of his life; and the following is a part of the ferocious verses he composed in the immediate prospect of the fate reserved for him, translated word for word by Olaus Wormius from the Runic original: "He only regrets this life who has never known distress: he who aspires to the love of virgins, ought always to be foremost in the roar of arms. In the halls of our father Balder (or Odin) I know there are seats prepared, where in a short time we shall drink ale out of the hollow skulls of our enemies. In the house of the mighty Odin no brave man laments death. I come not with the voice of despair to Odin's hall."

Mr. Gray has been peculiarly happy in inspiriting the old patriotic bard of Cambria with a similar contempt of death. The entire description is well known to every one; but it cannot be too often repeated, and ought not to be neglected on the present occasion. The picture of his standing on the battlements of Conway Castle, and terrifying the English conqueror with his dying prophecy as the latter was descending the shaggy steep of Snowdon, is exquisite and inimitable.

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* At liquidas avium voces imitarier ore
Ante fuit multo, quam lævia carmina cantu, &c.
Lib. v. 1378.

On a rock, whose haughty brow
Frowns o'er old Conway's foaming flood,
Robed in the sable garb of wo,
With haggard eyes the poet stood,
(Loose his beard and hoary air
Stream'd, like a meteor to the troubled air,)
And with a master's hand and prophet's fire
Struck the deep sorrows of his lyre.

The detail of the prophecy is too long for quotation; but the following fragments, which form its opening and ending, ought by no means to be omitted.

Ruin seize thee, ruthless king!
Confusion on thy banners wait!
Though, fann'd by conquest's crimson wing,
They mock the air with idle state!
Helm, nor hawberk's twisted mail,
Nor e'en thy virtues, tyrant! shall avail
To save thy secret soul from nightly fears—
From Cambria's curse, from Cambria's tears!
—Fond, impious man! think'st thou yon sanguine cloud,
Rais'd by thy breath, has quench'd the orb of day?
To-morrow he repairs the golden flood,
And warms the nations with redoubled ray,
Enough for me!—with joy I see
The different doom our fates assign.
Be thine despair, and sceptre'd care—
To triumph and to die are mine.—
He spoke: and headlong from the mountain's height
Deep in the roaring tide he plunged to endless night.

The first of these descriptions is derived from a people of Gothic or Scythian origin, whose ferocity of manners I have formerly pointed out, and endeavoured to account for: the second refers to a race of Celts or Cymbrians, for the most part of milder affections, and some tribes of which appear at a very early era of their history, and even in the infancy of civilization, to have evinced a tenderness of sentiment, a fecundity of imagery, and a cultivation of style, that are truly wonderful, and have never been satisfactorily accounted for. And I now particularly allude to the traditional poems of the Highlands and the adjoining isles, so well known from Mr. Macpherson's translation, and occasional interweavings. Such is the elegance and delicacy of taste, as well as sublime genius and national enthusiasm of these singular productions, that Dr. Johnson, as many of us may perhaps recollect, was to the last an infidel as to their genuineness. The first, however, has been sufficiently ascertained of late by the indefatigable and valuable exertions of the Highland Society, formed for the express purpose of inquiring into the nature and anthenticity of the poems of Ossian, the Homer of the highlands; whose report has been published by Mr. Mackenzie, their liberal and enlightened chairman. They have sufficiently established the important fact that Ossian is not an imaginary being; that his name and general history are at this moment preserved by tradition over the whole of the Highlands and the Hebrides; and that several of his poems, to an extent of many hundred lines, as literally rendered by Macpherson, still live in the memory of many of the oldest inhabitants, of the simplest manners, and who are incapable either of writing or reading, having been taught them by their fathers in early life, as their fathers had in like manner received them from a long line of progenitors through an immemorial period. These poems, or fragments of poems, have in various instances been taken down in the original Gaelic, from the mouths of the venerable reciters, by persons of the greatest respectability, many of them appointed for this purpose by the Society I am now speaking of, and on being compared with each other, and with Macpherson's version, have been found to possess a close and literal agreement, in many instances through a range of some hundreds of lines, particularly in the important poems of Caricthura and Fingal. While, to enable the public to form a fuller judgment upon the subject, and to free themselves from every charge of prejudice, the committee, in their very excellent report, have not only given an unmutilated copy of their correspondence, but extensive specimens of the original Gaelic itself, together with a new and verbal translation as well as Mr. Macpherson's version.

Against such evidence it is impossible to shut our eyes; and, admitting it, we must conclude with the committee, that, though Mr. Macpherson may have taken occasional liberties with the text from which he translated, omitted some passages, and supplied others that were perhaps lost, yet that the poetry called Ossianic is genuine; that it was common, and in great abundance; that it was peculiarly striking and impressive, and in a high degree eloquent, tender, and sublime. Of the epoch in which Ossian flourished we can form a tolerable guess; for, with occasional references to several of the earlier Roman emperors, and especially to Caracalla, the son of Severus, who by Ossian is called Caracal, we find through the whole of his accredited poems a total unacquaintance with the Christian religion; and hence he can scarcely be allowed to have lived earlier than in the second, or later than in the third or fourth century of the Christian era. So that the poems of Ossian must be of an antiquity not less by three or four centuries than the descent of Cæsar upon the British coast. And consequently we have at this moment a living proof of the existence of traditionary poems of the highest pretensions to genius, sublimity, and regularity of structure, that have been kept afloat in the memories of different generations for upwards of a thousand years, and some of them with but few variations, or loss of their original integrity.

To account, in some degree, for this striking and isolated fact, we must, in the first place, recollect, that these poems are strictly national; and, by a perpetual appeal to national passions and feelings, must have deeply interested every one who heard them in their preservation. Secondly, we know from the writings of Julius Cæsar, that the British druids, and consequently the British bards, on his landing, were embodied into distinct colleges, subject to a discipline of rigid study, and compelled to commit to memory so great an extent of verses, that many of them required not less than twenty years to complete this part of their education; it being held impious to record sacred poems in written characters, or to transmit them in any other way than by tradition from race to race. And, lastly, it should not be forgotten that poetry constituted the noblest science of these early times, and that the highest honour a hero could receive was to be celebrated in deathless verse. To die unlamented by a bard, was deemed, indeed, so great a misfortune as even to disturb the ghosts of the deceased in another state. "They wander," says the son of Fingal, "in thick mists beside the reedy lake: but never shall they rise WITHOUT SONG to the dwelling of the winds."

Ossian seems to have been wonderfully skilled in the language of all the passions. Equally vehement, gentle, and sublime, he could rouse at his will the fury of the brave, or melt him to tears of tenderness. The following passage, being part of the address of Fingal to his grandson Oscar, is full of heroism and fine feeling; and I give it from the version of Dr. Donald Smith rather than from that of Mr. Macpherson, as being not only more literal, but more beautiful.

> Son of my son! said the king,
> O Oscar, pride of the generous youth!
> I saw the gleaming of thy sword,
> And I gloried to behold thee victorious in the battle:
> Tread close on the fame of thy fathers,
> And cease not to be what they have been.
> When Trenmor lived, of glorious deeds,
> And Trathal, the father of heroes,
> They fought every battle with success.—
> Oscar! bend thou the strong in arms;
> Protect the weak of hand, and the needy,
> Be as a spring-tide-stream in winter
> To resist the foes of the people of Fingal;
> But like the soft and gentle breeze of summer
> To those who ask thine aid.
> So lived the conquering Trenmor;
> Such after him was Trathal, of victorious prowess,
> And Fingal—the support of the feeble.
> On a day when Fingal had but few in his train,
> By the fall of the soft murmuring Roya,
> There was seen to sail in the midst of the ocean
> A boat that conveyed a lovely woman.
> It neither halted nor slackened
> Till it reached the river-fall:
> When out of it rose the beauty of female form.
> She shone as a beam of the sun:
> Her look exceeded her figure.
> "Branch of beauty! covered with the dew of grief,"
> This calmly I said,
> "If blue [naked] swords can defend thee,
> "Our dauntless hearts will second them."
> "Thy protection I claim, for thou art Fingal,"
> Replied the daughter of youth:
> "By the excellence of thy might, and by thine eloquence
> "I claim speedy and opportune protection.
> "Thy countenance is a sun to the forlorn,
> "Thy shield is the dwelling-place of mercy.
> "I am pursued over the sea:
> "A hero of heavy wrath is following my track;
> "The son of Sora's king pursues me;
> "The mighty chief—whose name is Mayro Borb."
> "Rest thou here under my protection,
> "Beautiful form of the fairest hue!
> "And, in defiance of Mayro Borb,
> "Thou shalt find safety under the shade of my shield."

Perhaps the two sublimest passages in the poems of Ossian are, his Address to the Sun in his Carthon, and his description of the Spirit of Loda in his Caricthura, the genuineness of both which is ascertained beyond the power of suspicion. The first evinces sublimity combined with exquisite tenderness; and has a near resemblance to Milton's admirable address of the same kind. The second evinces sublimity combined with majestic terror, and has as near a resemblance to the mighty Spirit of the Cape in Camoens's Lusiad, though it is greatly superior. We have not time for quoting both these passages, and I shall confine myself, therefore, to the latter. I shall quote from Mr. Macpherson's version, which is sufficiently true to the original.

"The wan cold moon rose in the east. Sleep descended on the youths. Their blue helmets glitter to the beam. But sleep did not rest on the king. He rose in the midst of his arms, and slowly ascended the hill, to behold the flame of Sarno's tower.—The flame was dim and distant; the moon hid her red face in the east. A blast came from the mountain; on its wings was the spirit of Loda. He came to his place in his terrors, and shook his dusky spear. His eyes appear like flames in his dark face: his voice is like distant thunder. Fingal advanced his spear in night, and raised his voice on high. 'Son of night, retire: call thy winds, and fly! Why dost thou come to my presence with thy shadowy arms? Do I fear thy gloomy form, spirit of dismal Loda? Weak is thy shield of clouds; feeble is that meteor thy sword! The blast rolls them together: and thou thyself art lost. Fly from my presence, son of night! call thy winds, and fly!'

"'Dost thou force me from my place?' replied the hollow voice. 'I turn the battle in the field of the brave. I look on the nations, and they vanish: my nostrils pour the blast of death. I come abroad on the winds: the tempests are before my face. But my dwelling is calm above the clouds; pleasant are the fields of my rest.'

"'Dwell in thy pleasant fields,' said the king. 'Let Comhall's son be forgotten. Do my steps ascend from my hills into thy peaceful plains? Do I meet thee with a spear on thy cloud, spirit of dismal Loda? Why then dost thou frown on me? Why shake thine airy spear? Thou frownest in vain: I never fled from the mighty in war; and shall the sons of the wind frighten the king of Morven? No—he knows the weakness of their arms.'

"'Fly to thy land,' replied the form: 'take to the wind, and fly! The blasts are in the hollow of my hand: the course of the storm is mine. The king of Sora (the enemy of Fingal) is my son; he bends at the stone of my power. His battle is around Caricthura; and he will prevail! Fly to thy land, son of Comhall, or feel my flaming wrath!'

"He lifted high his shadowy spear! he bent forward his dreadful height. Fingal, advancing, drew his sword, the blade of dark-brown Luno. The gleaming path of the steel winds through the gloomy ghost. The form fell shapeless into air."

Ullin, Orran, and other ancient Gaelic bards, seem to have been almost as celebrated as Ossian; and even of Ossian's poetry Mr. Macpherson has not perhaps, after all, selected the most beautiful. The "Death of Gaul," published in 1780, by Dr. Smith of Campbelton, in Argyleshire, and accompanied with the original, as taken down from the memory of different Highland families, is one of the sweetest and tenderest, and at the same time one of the most regular pieces that has ever been composed in any language. Gaul was the bosom friend of Oscar, the son of Ossian, and the grandson of Fingal. The story in few words is as follows. Fingal summoned his heroes for an expedition to the isle of Ifrona. A flood in the river Strumon prevented Gaul from joining them in time: but he put forth in his bark alone on the ensuing day. On his voyage he passed his friends, who were returning victorious, without his perceiving them, and landed singly on the hostile shore. Consistently with the chivalrous honour of the times, he would not fly; but struck his shield as a token of defiance to the islanders, against whom he maintained, singly, a desperate conflict, and kept the enemy at a distance; till at length a stone, rolled from above, disabled him from moving or fighting any longer; in which situation he was left by the dastardly enemy to pine and die without succour. His wife Evirchoma anxious for his fate, embarked, with her infant son Ogall at her breast, in quest of her lord, whom she found in this pitiable condition; when rousing all her might to assist him, she just succeeded in dragging him to the boat, and then fainted away over his body; in which state, speechless and in the act of dying, they were both discovered the next morning by Ossian, who had sailed in quest of them, and who was only able to save the child. From the poem thus introduced, and which is not generally known in this part of the island, I must beg leave to offer an extract or two. The following is Ossian's description of Evirchoma, as she witnessed the mournful departure of her husband:

In the light ship of rough waves
The hero followed us on the second morning.
But who is she on the rock like mist,
Looking, through tears, on Gaul?
Her dark hair wanders on the wind,
And her soft hand, white as foam, surrounds her forelock.—
Young is the boy on her bosom,
Sweet is her lullaby in his ear.
But a sigh has wafted away the song:—
On Gaul are thy thoughts fixed, Evirchoma.

The following is an exquisite picture of mingled and overwhelming passions—courage, heroism, and tenderness. Having chivalrously planted his standard, and singly defied all the enemy, a rushing thought of his wife and his child, of Evirchoma and Ogall, damps his resolution for a moment; but he is instantly recalled to himself by the idea of the spirit of his heroic father hovering over him:

Morni! behold me from the mountain.
Thy own soul was an impetuous current,
Foaming white within a rocky strait:
Such is the soul of thy son.—
Evirchoma!—Ogall!—
But mild beams belong not to the storm;
The soul of Gaul is in the roar of battle.

The conflict of passions in the breast of Evirchoma, on reaching the hostile shore, is described with equal force—her desire to proceed in quest of her husband, and her fear of leaving her babe behind her in the boat. It was now late in the evening:

She glanced by the scanty beam
On the beautiful face of her son,
When about to leave him in her narrow skiff:
"Babe of my love! be here unobserved!"
As a dove on the rock of Ulacha,
When gathering berries for her tender brood,
Returns often without tasting them,
While the hawk rises in her thoughts;—
So returned three times Evirchoma:
Her soul, as a wave that is passed
From breaker to breaker when the tempest blows,
Till she heard a mournful voice from the tree of the shore.

I have said that the generous Ossian pursued them in another boat, and found them both in the act of dying. The following is his own inimitable description: it is strikingly impressive, and especially the manner in which the faint and dying mother commends her son to his care; and calls forth a sigh from his heart that his own wife Evirallin is no more.

I lifted his helmet: I saw his locks
Disordered, uneven in sweat.
My cry arose—
And he raised with difficulty his eye.
Death came, like a cloud on the sun:—
No more shalt thou see thy Oscar.——
The beauty of Evirchoma is darkened.
Her son, unconscious, holds the end of a spear:
Feeble was her voice, and few her words.
I raised her up with my hand,
But she laid my palm on the head of her son,
While her sigh rose frequent.——
Dear child! vain is thy fondling;
Thy mother no more shall arise.
I will myself, be a *father* to thee:——
But Evirallin is no more.

Yet the poem must not be closed without giving you its conclusion; its exquisite moral and its sublime epitaph.

What is the strength of the warrior,
Though he scatter the battle as withered leaves?
To-day though he may be valiant in the field,
To-morrow the beetle will *triumph over him.*
  Prepare, ye children of musical strings,
The bed of Gaul and his sun-beam [standard] by him;
Let his resting-place be seen from afar,
By high branches overshadowed;
Under the wing of the oak of greenest foliage,
Of quickest growth, and most durable form,
Shooting forth its leaves to the breeze of the shower,
When the heath around is still withered.
  Its leaves, from the extremity of the land,
Shall be seen by the birds of the summer;
And each bird shall perch, as it arrives,
On a sprig of its verdant branches.
Gaul, in his midst, shall hear their cheerful note,
While the virgins are singing of Evirchoma.
  Until all of these shall perish,
Never shall your memory be disunited,
Until the stone shall crumble into dust,
And the oak-tree decay with age;
Until streams shall cease to flow,
And the mountain waters be dried up at their source;
Until there be lost, in the flood of age,
Each bard, and song, and subject of story.
The stranger shall not ask, "who was Morni's son?"
Or "where was the dwelling of the king of Strumon?"

The voice of the passions, then, whether of joy or sorrow, of rage or tenderness, is the voice of poetry; and the voice of poetry is, in consequence, the voice of the passions. It is hence the earliest language of every nation; and it is not, therefore, to be wondered at that it should have been employed from a very remote period as the medium of national history, national mythology, and moral precepts; its glowing and animated style being peculiarly calculated to captivate the attention, and the recurrent measure of versification which, under some shape or other, it has assumed, and could not fail to assume, in every part of the world, being admirably adapted to assist the memory.

Hence in the first ages of Greece, as well as of every other nation, priests, philosophers, and statesmen, all delivered their instructions in poetry. Apollo, Orpheus, and Amphion, the earliest bards of the Grecian states, are represented as the first tamers of mankind, the first founders of order and civilization. Minos and Thales sung to the lyre the laws which they composed; and, till the age immediately preceding that of Herodotus, history appeared in no other form than that of poetical tales. At this time, however, science began to rear her head through the regions of Arcadia; the judgment acquired daily strength; and, while a soberer style was found to be befitting the severer studies, and the simple narrative of national or biographical events, the dialect of the passions was limited to those branches of speech or writing which require ornament, attraction, or an excitement of the passions themselves: and by such a change verbal composition soon rose to the rank of a very extensive and complicated science; the value of every word became weighed in its root, combinations, and inflections; in its strict and figurative senses; in its proper enunciation and accent. And hence the origin of the elementary studies of etymology, grammar, prosody, and criticism; while the general mint of language, thus prepared and struck off, was still subject to the inquisitorial powers of logic and rhetoric; the art of reasoning or assigning determinate ideas to determinate words; and the art of polishing or adorning the dry skeleton of naked sense with the gay and ornamental dress of trope, figure, and elegant collocation.

Rhetoric, therefore, is nothing more than the natural language of the passions or the imagination which so closely associates with them, reduced to the rules of art. It is the study of those peculiar modes of expression, warm, exclamatory, abrupt, interjective, full of energy, image, and personification, by which the passions characterize themselves when called into action; and which, as the natural symbols of the passions, have the wonderful power, not only during recitation, but on paper alone, when read by ourselves in the privacy of the closet, of enkindling in the mind of the reader or hearer the very feelings of which they are the representatives.

Hence the soothing tranquillity produced by pastoral poetry; the melting sympathy with which we yield to metrical tales of distress and misery; the rousing, dithyrambic effect of national songs; the sublime enthusiasm of devotional lyrics. Hence the well-planned fictions of the epic Muse excite all the interest of real life; the popular orator, lying hold of the same weapons, subdues every heart to his own purposes; but, above all, hence the magic spell of the drama, that, by personating the characters and scenery of the subject it selects, transports us to the time, place, and circumstance of the representation, and makes us parties to its own story.

The drama, above every thing else, is the language of the passions carried into real life, and enlisted on the side of virtue. I say on the side of VIRTUE, because such power has virtue over the human mind, by the wise and gracious constitution of our nature, that neither epic poetry can excite admiration, nor tragic poetry emotion, unless virtuous feelings be awakened within us. Every poet finds it impossible to interest an audience in a character without representing that character as worthy and honourable, though it may not be perfect; and he is equally aware that the great secret for raising indignation, is to paint the person who is to be the object of it in the colours of VICE and DEPRAVITY. And hence, Aristotle speaks with his usual correctness, when he tells us, that the design of tragedy, (and it is to the tragic drama I am now limiting my attention) is to purify our corrupt tendencies by means of pity and terror. Such was the direct scope of the simple tragedy of the Greeks; the uniform object of Æschylus, who founded it; of Euripides, who improved; and of Sophocles, who perfected it; and all within the short space of little more than twenty years.

And such is equally the object of the more operose and complicated tragedy of modern times, whether French or English; whether turning, as in the former case, upon a series of artful and refined conversations, connected, indeed, with interesting attractions, but carried on with little action and vehemence, though with much poetical beauty, and the strictest propriety and decorum; or whether, as in the latter instance, made to hinge on a combat of strong passions, set before us in all their violence, producing deep disasters; often irregularly conducted, abounding in action and filling the spectators with grief. It is, indeed, peculiarly worthy of remark, that three of the greatest, if not the three greatest masterpieces of the French tragic theatre, turn wholly upon religious subjects: the Athalie of Racine, the Polyeucte of Corneille, and the Zaire of Voltaire. The first is founded upon an historical passage of the Old Testament; while, in the other two, the distress arises from the zeal and attachment of the principal personages to the Christian faith. So powerfully has each of these writers felt, whatever may have been his private creed, the majesty which may be derived from religious ideas, and the deep impression they are calculated to produce on the human heart.

To select such topics, however, for such a purpose, demands a very delicate judgment: and no serious mind would readily consent, I apprehend, that they should be resorted to and promulgated as sources of entertainment in the theatres of our own country. I mention the fact with the mere view of contrasting it with what has of late years been the predominant and licentious taste of the French metropolis; and to show the readiness with which this polite and elegant, but gay and giddy people, rush from one extreme to the other of that sober medium which will, I trust, ever limit and characterize our own national feelings and conduct.*

It is well known to have been the opinion of Dr. Johnson, that religious subjects are but little calculated for poetry of any kind; that the fire of the Muses will not cordially blend with the flame of devotion. From this opinion, however, I must beg leave altogether to dissent.

There is no topic so well qualified for enkindling and enlisting into its service all the best and purest passions of the heart; and none, therefore, to which the language of the passions, subject, indeed, to the discipline of a nice judgment, is better adapted, or can be more laudably consecrated. And on turning accidentally to Sir William Jones's "Essay on the Arts commonly called Imitative," I find this opinion fortified; and the general survey of the subject now offered supported by the authority of this great scholar, whose name and judgment I may fairly put into the scale against those of our celebrated lexicographer.

"It seems probable, that poetry was originally no more than a strong and animated expression of the human passions, of joy and grief, love and hatred, admiration and anger, sometimes pure and unmixed, sometimes variously modified and combined: for, if we observe the voice and accents of a person affected by any of the violent passions, we shall perceive a something in them very nearly approaching to cadence and measure; which is remarkably the case in the language of a vehement orator, whose talent is chiefly conversant about praise or censure; and we may collect from several passages in Tully, that the fine speakers of old Greece and Rome had a sort of rhythm in their sentences, less regular, but not less melodious than that of the poets.

"If this idea be just, one would suppose that the most ancient sort of poetry consisted in PRAISING THE DEITY: for if we conceive a being created with all his faculties and senses, endued with speech and reason, to open his eyes in a most delightful plain; to view for the first time the serenity of the sky, the splendour of the sun, the verdure of the fields and woods, the glowing colours of the flowers; we can hardly believe it possible, that he should refrain from bursting into an ecstasy of joy, and pouring his praises to the Creator of those wonders, and the author of his happiness. This kind of poetry is used in all nations; but as it is the sublimest of all, when it is applied to its true object, so it has often been perverted to impious purposes by pagans and idolaters."*

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* It should be recollected that this Lecture was composed and delivered during the reign of Buonaparte.

It is true, the devotional poetry of our own country, that can pretend to any high degree of merit is but very sparing, when compared with what we may reasonably boast on most other subjects. Not, however, that we are without writers of high and deserved reputation, or specimens of admirable excellence and sublimity. Yet we must not judge, as Dr. Johnson appears to have done, from our own country alone: since perhaps, no people celebrated for great refinement in taste and language, have so little cultivated this branch of the poetic art. It is a remarkable fact, that the metrical psalmody of our established church, which ought to be the best, is the worst of all English poetry in its old version, and not always improved as one could wish in its new, though several of the psalms in this later version, are exquisitely turned.

And here it is obvious, that the fault does not lie with the subject, for the original Hebrew is full of excellencies of every kind. Our poets of the highest reputation, whether epic, dramatic, or lyric, have seldom ventured upon sacred themes; and in the few instances in which they have made such an attempt, they have too frequently proved themselves to be equally unacquainted with the style and character of devotion; which, like those of every other science, (for I am now only speaking of it in its subordinate and exterior attributes) can only be acquired by a peculiar genius for the task, and a long course of study in it. Let any one examine critically the *Universal Prayer* of Pope, or the *Veni Creator Spiritus*, or *Te Deum* of Dryden, and I have little doubt that he will accede to the correctness of this remark. There is a constraint in these productions, which belongs to the writers nowhere else; an elegant exterior, but without a vivifying spirit; a total want of that happy union of bosom ease and ardour, and raciness, which the French Theologians call *unction*, that prove a man to be at home upon his subject, and to have drunk deeply of the inspiring stream, and that it circulates freely through his heart: that which renders Addison as much superior to both these poets upon this point, as he was inferior to them upon every other; which is deeply impressive in Cowper's devotional pieces; which peculiarly characterizes, not only the more lofty and ornamental, but even the mere doctrinal hymns of Dr. Watts, which admit of but little embellishment; and which we sometimes behold in the congregational contributions of persons possessing few pretensions to learning and genius, and who, perhaps, make a boast of their deficiency.

Let it be remembered, that elegance alone will not answer, nor will ease alone answer, nor will general descriptions alone answer; whether of the perfections of the Deity, the beauty of creation, the penitence of the soul, or its ardent longing for the happiness of Heaven, or for communion with God on earth. We have at times seen attempts of this kind (and many of us, as I trust, with real grief of heart,) by lyrical writers of the first attainments as poets, but the lowest attainments as Christians, in our own day; and whose direct object has been to furnish words to what has been vended along with them under the name of **Sacred Music**; to cheat the sacred hours of the Sunday, and of those who hail the return of the Sunday, by a show of Sunday-ailment and occupation. Such attempts have had their day, but have never been able to support themselves. In the midst of all their external glitter and polished rhapsody, they have been found vapid and unsatisfactory; an airy, flatulent food, that the soul could never feed or fatten upon. And, on analyzing several of these attempts, with a friend of the nicest judgment, and who was, at first, strangely captivated by their pretensions, we found, that by a change in a very few of the terms, chiefly, indeed, by a mere substitution of human names for divine, they were reduced, with great advantage to themselves, to their proper and natural level of love-ditties and ballads, from which alone they seem to have been raised, by an irreverent adoption of mere misnomers for the base purpose of finding them a market in what is called the religious world.

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* Essay on the Arts commonly called Imitative Works, iv. 550. 4to.

On every account, however, I am much afraid that we must yield the palm of devotional poetry, to some of the nations on the continent. The best French writers upon this subject, are Racine the younger, son of the celebrated dramatist of the same name, John Baptiste Rousseau, and Pompignan; all contemporaries, and the last of whom had the honour of being ridiculed by Voltaire, Helvetius, and their associates, for having had the boldness to deliver before the French academy, in 1760, a discourse in favour of Christianity. And when to these I add the name of my late venerable friend, the Abbé Dellille, I fear it will be difficult to muster an equal group, possessing like power, in our own country. Spain, however, in this respect, at least rivals, if they do not surpass the master-poets of France; as I believe every one must allow who is acquainted with the sacred poetry of Melendez, Miguel Sanchez, and the Conde de Norona. Germany has also a few poets of the same kind of great merit, but it is to Italy we must turn for the best specimens of devotional lyrics in modern times;—Italy, where, almost from the revival of literature, the devotional muse, though surrounded by corruption, has been courted and warmly caressed by many of her best scholars, her best poets, and her best men. Her sacred verse was at first, indeed, too much interwoven with the mystic sublimity of Platonism, which pervades more especially the spirited and lofty verses of Lorenzo de' Medici. It next allied itself equally with classical mythology, generalizing the "Jehovah, Jove, or Lord," as Mr. Pope has it, of Christians and Heathens; under which system every Pagan deity had his name continued, and was regarded as nothing more than a separate attribute of the true God. Sanazzaro and Pontano, like the Portuguese epic poet Camoens, are full of this absurd amalgamation; but from the time of Vida to the present day, the devotional effusions of the Tuscan muse have been purged from foreign dross, and in subject as well as in style, while highly empassioned are equally pure, pious, and erudite. Were I to be called upon to point out the two best sacred poets of modern times, I should instantly name Filicaja and Klopstock; both men of exemplary goodness, whose lives were dedicated to religion, and who, while they wrote from the heart, adorned their compositions with every classical excellence. Bion has nothing sweeter or more touching than Klopstock; Pindar nothing more ardent or sublime than Filicaja.

Yet to determine the question fairly, whether religious subjects can afford a proper ground for poetry or the language of the passions, it is necessary to look back to nations of a very remote antiquity, and who cultivated such attempts as a national pursuit. Surely if the erroneous and extravagant mythologies and superstitions of ancient Greece possessed interest enough to concentrate equally the fond attention of the poets and the people, and to be laid hold of as the standard theme of odes, dramas, and epopees; if the sacred fictions of Isis and Osiris, of Ormuzd and Ahriman, of Brahma and Pracriti, were deemed the noblest subjects for song in Egypt, Persia, and Hindostan; and song, too, composed by the most learned hierophants and the most celebrated bards of their day, in colleges expressly founded for the occasion; what ought we not to look for in countries of coeval antiquity, preternaturally illuminated with the principles of genuine religion, and where colleges also were founded of the same mixed kind for the same lofty purpose? What ought we not to expect from the rapt patriarchs of Idumæa, or the inspired prophets of Salem; from the magnificent schools of Dedan and Theman, or those of Naioth and Mount Zion? From the two latter, more especially, since one of their chief, and certainly one of their most pleasing duties was to compose a regular series of sacred odes and other canticles to the praise of the great Creator, and to sing them daily to the skilful sound of psaltery, tabret, and harp, in sweet, alternate concert; and accompanied with the symphoneous movements of solemn attitudes and sacred dance. We have not time for examples, pleasant as the task would be, to introduce them; but the question seems to be unanswerably settled, by the general and well-known history of these countries, and the exquisite specimens of their sacred lyrics which have descended to our own day; and which prove unequivocally that the language of the passions, of hope and fear, of joy and sorrow, of compunction and triumph, are directly fitted to become the language of devotion; and that the purest and sublimest religion is capable of giving rise to the purest and sublimest poetry. The Bible indeed, which is the first book we should prize, and the last we should part with, is as much superior to all other books, whether of ancient or modern times, in its figurative and attractive dress, as it is in its weighty and oracular doctrines; in the hopes it enkindles and the fears it arrays. In its exterior as in its interior, in its little as in its great, it displays alike its divine original.

LECTURE XV.

ON TASTE, GENIUS, AND IMAGINATION.

Before we close our analysis of the faculties of the mind, there are yet three powers, that have a larger claim upon our attention than we have hitherto been able to give them. These are the faculties of TASTE, GENIUS, and IMAGINATION; the alliance between which is so close, that many philosophers have conceived they are produced at the same moment, and cannot exist separately. This, however, is an erroneous opinion proceeding from a want of clear ideas as to their respective characters—characters which do not appear to have been at any time very accurately defined; and the peculiar limits and distinctions of which I shall take leave, therefore, before we close this course of instruction, to fix by a new boundary.

Imagination, then, is that faculty of the mind which calls forth and combines ideas with great rapidity and vivacity, whether congruous or incongruous.

Genius is that faculty which calls forth and combines ideas, with great rapidity and vivacity, and with an intuitive perception of their congruity or incongruity.

Taste is that faculty which selects and relishes such combinations of ideas as produce genuine beauty, and rejects the contrary.

These definitions are simple, but, I trust, correct; and if so, imagination is the basis of the whole; taste may exist without genius, and genius without taste, as I shall presently endeavour to show; but neither can exist without imagination. Yet imagination is neither taste nor genius, since, though absolutely necessary to the subsistence of these powers, the great mart that furnishes them with their daily food, it may also exist without them.

Let us commence, then, with the faculty of imagination. Whence comes it that the mind, at first a tabula rasa, a sheet of white paper, without characters of any kind, becomes furnished with that vast store of ideas, the materials of wisdom and knowledge, which the busy and boundless fancy of man has painted on it with an almost endless variety? The whole, as I had occasion to prove in a preceding Lecture,* is derived from experience,—the experience of sensation and reflection; from what have been called objective and subjective ideas; from the observations of the mind employed either about external, sensible objects, or the internal operations of itself, perceived and reflected upon by its own faculties.

Now, it is the office of the reason to hunt out for and accumulate ideas from both the above sources, as it is that of the perception to distinguish them when present, and of the memory to recall them on future occasions. And hence he who has laid in the largest stock of ideas is possessed, not indeed of the most extensive knowledge, but of the most extensive materials of knowledge. For, in order to produce knowledge, we must not only have a numerous stock of ideas, but these ideas must be examined, compared, arranged, combined, according to their connexion and agreement, or disconnexion and repugnancy. To do this is the office of the judgment; and hence he who has a power of making such assortment and comparison with clearness and precision is said to have a deep insight into things; which is nothing more than affirming that the faculty of his judgment is correct and acute. I have stated genius to be that faculty by which the mind rapidly or intuitively perceives the congruity or incongruity of ideas; so that genius is intuitive judgment; it is judgment that looks forward at once from the beginning to the end of a chain of ideas, and stands in little or no need of the intermediate links on which proper or common judgment depends for its guidance.

We often, however, meet with persons who have a strong and active propensity to combine ideas, without any attention to their natural agreement or connexion. And it is in individuals of this description that the imagination constitutes the ruling power, and lords it over the judgment. Such combinations are soon made, for they cost no trouble, like those the judgment engages in: and as the persons who are constitutionally prone to make them, possess, perhaps without an exception, a sanguineous or irritable temperament, the nature of which I explained in a late lecture of the present series,* they are also made with peculiar liveliness and rapidity, and I have hence defined the imagination to be that faculty of the mind which calls forth and combines ideas with great rapidity and vivacity, whether congruous or incongruous.

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* S Lect. III.

This, however, is pure or simple IMAGINATION, and to observe it in its full force we must select and attend to those states of the mind in which it is altogether set at liberty from the control of the judgment; we must follow it up into the airy visions of sleep, the wild phantasms of delirium, the extravagant fictions of madness, or the dark reveries of melancholy. In all these states it has full play and revels with unbounded career. And it shows us distinctly the error of those psychologists who have regarded imagination, genius, and fine taste, as one and the same attribute. For here we behold the restless power of imagination enthroned without a rival in the centre of the intellectual empire, and yet unaccompanied, except perhaps in a few anomalous cases, with taste or genius of any kind. A long habit of association, in the case of dreaming and delirium, or some predominant feeling in the case of madness or melancholy, may occasionally give a certain degree of consistency or natural colouring to the ideas as they are successively embodied; and I have hence described the ideas of imagination as characterized by rapid and vivacious combinations, whether congruous or incongruous; but for the most part the consistency is only occasional and momentary; or of permanent, limited to a single subject.

Tried by this test, I am afraid Dr. Akenside, among others, will be found to have fallen into some slight confusion in his idea of imagination or fancy (for he uses the terms synonymously) as collected from his well-known and very admirable poem—a poem in a few places, perhaps, obscure to general readers from their unacquaintance with the Platonic philosophers, but combining as much fire, and feeling, and classical elegance, and rich imagery, and sweetness of versification, as any didactic poem of the same extent in the English tongue. This poem he entitles "The Pleasures of Imagination;" and the direct scope of it is to prove, firstly, that the highest pleasures of the mind are those furnished by the imagination; and secondly, that they are derived from the three sources of the Fair, the Wonderful, and the Sublime, as they are discoverable in the kingdoms of art and nature, and are chiefly collected and represented to us by poets and painters:

> Know, then, whate'er of nature's pregnant stores,
> Whate'er of mimic Art's reflected forms,
> With love and admiration thus inflame
> The powers of FANCY, her delighted sons
> To three illustrious orders have referred;—
> Three sister-graces—whom the painter's hand,
> The poet's tongue confesses: the Sublime,
> The Wonderful, the Fair.—I see them dawn!
> I see the radiant visions where they rise,
> More lovely than when Lucifer displays
> His beaming forehead through the gates of morn,
> To lead the train of Phœbus and the Spring.

Who does not see that, through the whole of this the poet is speaking, not of fancy or imagination in its proper and simple capacity, but of fancy or imagination under the guidance of taste and genius; and that, consequently, he confounds these three faculties, different as they are from each other, under one common name. In like manner Mr. Allison commences the second edition of his "Essays on the Nature and Principles of Taste," with the following passage: "The emotions of sublimity and beauty are uniformly ascribed, both in popular and *philosophical* language, to the imagination. The fine arts are considered as the arts which are addressed to the imagination, and the pleasures they afford are described, by way of distinction, as the pleasures of the imagination." Now this may be popular language, but it is by no means philosophical. The poet as a poet may talk of the pleasures of imagination, because he limits his ideas to pleasurable objects; and submits them to the selective hand of genius and taste; but will the madman, or even at all times the lover, talk also of its pleasures? Shakspeare tells us, no; and in proof hereof gives us in his Midsummer Night's Dream an exquisite picture of the different subjects on which their respective imaginations are exercised:

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* Ser. III. Lect. XI.

> Lovers and madmen have such seething brains,
> Such shaping phantasies that apprehend
> More than cool reason ever comprehends.
> The lunatic, the lover, and the poet,
> ARE OF IMAGINATION ALL COMPACT.
> One sees more devils than vast hell can hold;
> That is the madman. The lover, all as frantic,
> Sees Helen's beauty in a brow of Egypt.
> The poet's eye in a fine phrenzy rolling,
> Doth glance from heaven to earth, from earth to heaven,
> And as imagination bodies forth
> The forms of things unknown, the poet's pen
> Turns them to shapes, and gives to airy nothing
> A local habitation and a name.

This indeed is the language of philosophy though put into verse. The madman, the lover, and the poet, are described as being joint subjects to the dominion of imagination; while the general current of their ideas, from its vehemence, abruptness, and audacity, is denominated a phrenzy. But the phrenzy of the poet, is distinctly stated to be of a superior kind to that of the rest, and is distinguished by the epithet *fine*, delicate, refined, polished; and consequently imports skill or regulation; taste, genius, or both together. It necessarily implies a something besides the simple imagination, that unites with and controls it; and hence accurately accords with the view of the subject now taken.

Let us proceed to the faculty of GENIUS. This I have defined to be that power of the mind which calls forth and combines ideas with great rapidity and vivacity, and with an intuitive perception of their congruity or incongruity.

Genius is, therefore, in few words, imagination with intuitive judgment. It distinguishes the man of FINE PHRENZY, as Shakspeare expresses it, from the man of MERE PHRENZY. It is a sort of instantaneous insight, that gives us knowledge without going to school for it. Sometimes it is directed to one subject, sometimes to another; but under whatever form it exhibits itself, it enables the individual who possesses it to make a wonderful and almost miraculous progress in the line of his pursuit. Sometimes it attaches itself to the sweet harmony of sounds, and we then behold an infant of eight or ten years of age evincing the science and execution of an adult and finished musician. Sometimes it rejects the science of sounds and prefers that of numbers; and we behold a boy of twelve years old solving, almost instantaneously, arithmetical questions which would cost an expert practitioner in the common way, a labour of many hours. Sometimes we find it enamoured of the beauty of colours or the charms of eloquence; and we are struck with the precocity of perfection which it evinces in either case.

In other instances, we see it descending to the arts and labours of common life, and diffusing intuitive knowledge among the multitude. Go to the busy 'Change, and you will find some individuals, allowed by general consent to have a peculiar genius, or talent, as it is often called, for commerce; in other words, who are capable of calling forth and combining commercial ideas with great speed and vivacity, and with that intuitive perception of their agreement or disagreement which leads them to the most judicious results—results which the surrounding crowd would only be able to obtain by a long catenation or process of inquiry. Go into the country, and you will find the same difference among our husbandmen and agriculturists; while some among them have no more imagination than the clods they cleave with their ploughshares, others seem to penetrate intuitively the nice order of vegetation, and never suffer a season to roll over them without wringing from it some important secret; as Aristæus in the Georgics from the pinioned form of old Proteus. Go to our manufacturing and mechanical towns; to Manchester, Birmingham, and Sheffield; and you will, in like manner, meet with artisans and handicrafts who discover the same acuteness of intelligence, the same rapid combination of consenting ideas, the same superiority of genius or talent in their respective callings beyond that which is possessed by their fellows, as in the cases to which I have alluded already.

Genius, then, wherever it is found, and to whatever purpose directed, is mental power; it acts by an invisible impulse, and appears to act miraculously. And hence, indeed, its name—a name common to all the world—derived from the Hebrew, copied thence into the Sanscrit, Arabic, and Chinese; from the eastern tongues into the Latin, and from the Latin into our own, and almost every other language of modern Europe, and importing, in every instance, in its radical signification, a tutelary, a guiding or inspiring divinity.

It is genius, then, that must control the imagination, if the pictures it paints be of any value, if the ideas it combines be combined skilfully or accordantly, if the feelings it excites be pleasurable, or the result it produces be beneficial.

To give full efficacy, however, to the daring flights of the imagination, there is another power of the mind which must associate with the attribute of genius, and that is TASTE; which I have already defined to be that mental faculty which selects and relishes such combinations of ideas as produce genuine beauty, and rejects the contrary.

Imagination, therefore, is as necessary to the existence of taste as of genius; since each equally depends upon this active and vivacious power for the materials with which it is to work. For the most part, taste and genius are united in the same mind, but not necessarily or always so; and hence they are by no means the same thing.

We see evident proofs of this in many of the subjects selected by the lower class of the Dutch painters, and by several of the most eminent caricature draughtsmen of the present day. The broad laughter or other distortion of the features, which they so frequently present to us, often discovers a powerful genius in this particular line, and, as displaying the effect of muscular action, may afford to the young painter a useful study; but the ideas are too ludicrous and violent for real beauty, and have, hence, no pretensions to pure taste.

Among the whims and follies which have successively risen into notice in our own country, there appears, at one time, among the lower ranks of life, to have been an odd and singular fashion for grinning. The third volume of the Spectator contains a paper that gives a very humorous account of this elegant rage; and informs us that grinning clubs were established in different parts of the country, grinning matches proposed, and grinning prizes adjudged to the winner. Among the competitors in this new Olympic game, there were some who seem to have been endowed with a peculiar genius for the art; and in one instance the prize fell upon a cobbler, who discovered so much accomplishment and excited so much applause, that a hard-hearted young woman whom he had in vain wooed for five years before, immediately gave him her hand, and was married to him the week following. Now here, as in the Dutch paintings I have just noticed, whatever may have been the genius displayed, every one, I apprehend, will admit that it was genius without taste.

Let us, however, ascend to nobler regions. We occasionally meet with particular instances of deficient taste in persons of the most elevated genius, and whose general taste is acknowledged by every one to be sufficiently correct. As one instance, I may perhaps mention that Reubens, in his very excellent picture of Daniel in the lion's den, has given a human expression to the faces of the savage beasts. His intention is clear; it is that of representing them as endowed with human feeling on the occasion. The conception unquestionably implies genius, but its taste will not be so readily allowed. We meet with a similar error in the battle of Constantine, by Giulio Romano, where the face of one of the horses is, for the same reason, animated with a human character, expressive of doubtful thought and suspicion; while the ears and hair of the forehead, for the sake of greater fierceness, are drawn from the features of the bull. Now, in centaurs, chimæras, and other ideal animals, this intermixture of attributes is readily allowable, for here the imagination may sport without restraint; but it is a law of genuine taste, that natural objects should have their natural characters, their proper features and expression; or, in other words, that the principle of association adhered to by nature should be adhered to by those who copy her.

Our best and most celebrated poets furnish us occasionally with similar instances of genius unaccompanied by taste. Homer himself is not altogether free from this imputation. Let me first set before you one of his most exquisite pictures, in which taste and genius equally combine. The passage I refer to is his delineation, in the eighth book of the Iliad, of a night scene before Troy. Mr. Pope's is an excellent version, but I take Mr. Cowper's as equally excellent and more true to the original:—

> As when around the clear bright moon, the stars
> Shine in full splendour, and the winds are hush'd,
> The groves, the mountain-tops, the headland heights
> Stand all apparent, not a vapour streaks
> The boundless blue, but ether open'd wide
> All glitters, and the shepherd's heart is cheer'd:
> So numerous seem'd those fires between the stream
> Of Xanthus blazing, and the fleet of Greece,
> In prospect all of Troy.

Could it be supposed, that he who could imagine so finely, and describe so delicately, would in the same poem compare the contest of the Greeks and Trojans for the body of Patroclus, which it seems was tugged for in every direction, to a gang of curriers stretching out a hide? Or, that in his Odyssey, he would liken Ulysses, restless and tossing on his bed, to a hungry man turning a piece of tripe on the coals for his supper?

Now, in both these cases the similes are true to nature, and strikingly illustrative; they are full of genius, but they are destitute of taste; they want picturesque beauty. To nature, indeed, they must be true; for the merit of Homer as a painter from nature is that in which he stands most distinguished from all other poets. In variety, accuracy, and force, his similes greatly surpass those of any of his successors and imitators; and they form a gallery of delineations which the student of poetry and the cultivator of genius cannot survey with too much attention:—

> Be Homer's works your study and delight,
> Read them by day, and meditate by night;
> Thence form your judgment, thence your maxims bring,
> And trace the muses upwards to their spring.*

In looking very lately over the satires of Dr. Young, which, upon the whole, are written with great force and truth of character, I could scarcely avoid smiling at a simile which, like the preceding, is exact enough in itself, but highly ludicrous from its utter deficiency of taste. In describing the man whose whole pursuits are made up of nothing but trifling and empty joys, he compares him to a cat in an air-pump. Now, this might have been well enough in Hudibras, or any other burlesque poem; but it is altogether inconsistent with a vein of serious composition. In the following comparison, on the contrary, he is highly ingenious and successful; and we admire the adroitness with which he brings into various points of resemblance ideas that at first sight appear to be perfectly discrepant; for quicksilver and pleasure do not seem to have any natural connexion:—

> Pleasures are few, and fewer we enjoy;
> Pleasure, like quicksilver, is bright and coy;
> We strive to grasp it with our utmost skill,
> Still it eludes us, and it glitters still.
> If seiz'd at last, compute your mighty gains,
> What is it but rank poison in your veins?

There is no subject that has been more frequently made choice of by dramatic writers than the story of Œdipus Tyrannus. We owe it, in the first instance, to Sophocles; and the best copies of it in modern times are those by Corneille and Voltaire. It is unquestionably full of suspense, agitation, and terror; and particularly of that incident in a plot which by the Greeks was termed *anagnorisis*, or the discovery of a person to be different from what he was taken to be. Yet, as a whole, there has always appeared to me to be far more genius in the conduct of the fable than there is of real taste or beauty. The story is, in few words, as follows:—An innocent person, and, in the main, of a virtuous character, through no crime of himself or of others, but by mere fatality and blind chance, is involved in the severest train of all human miseries. In a casual rencounter he kills his father without knowing him; he afterwards, with equal ignorance, marries his own mother; and at length, discovering that he had committed both parricide and incest, he becomes frantic and dies in the utmost misery. Such a subject excites horror rather than pity. As conducted by Sophocles, it is, indeed, extremely affecting, but it conveys no instruction; it awakens in the mind no tender sympathy; it leaves no impression favourable to virtue or humanity.* It is without the moral for which tragedy was invented.

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* Art of Criticism.

Genius, then, may exist without taste; in like manner, taste may exist without genius. Of this we meet with a thousand instances every day of our lives. How countless are the numbers that are perpetually poring over the elegant and picturesque poems of Lord Byron and Mr. (now Sir) Walter Scott; or that are perpetually hurrying to Mr. West's impressive picture of the "Healing the Sick in the Temple;" or that of "Christ rejected;" entering with the nicest feelings into the various groupings, characters and scenery which are so exquisitely presented to them; and who, nevertheless, though endowed with a taste that enables them to relish such excellencies, have no genius whatever that could either invent or copy them. In like manner, I have occasionally met with men, who for strength of feeling and elegance of taste are almost unrivalled, and whom the world has long regarded, and justly so, as among the finest critics of the present day on subjects of polite literature; yet, notwithstanding such possession of exquisite and acknowledged taste, who have never been successful in the exercise of genius, and have uniformly failed in poetry and original fiction. It is rarely that taste and genius do not co-exist in the same mind; but it is also rarely, that they co-exist in an equal degree. Ariosto and Shakspeare excel in genius; Tasso and Racine in taste. Mr. Windham had as much genius as Mr. Burke; his imagination was as vivacious and rapid, his combination of congruous ideas as instantaneous, his wit, perhaps, even more ready and brilliant—But Mr. Burke was vastly his superior on the score of taste.

Taste and genius cannot but be favourable to virtue. They cannot exist conjointly without sensibility. While it is of the very essence of vice to have its feelings blunted, its conscience seared, their pleasures are notoriously derived from elevated and virtuous sources. There may, perhaps, be a few exceptions to the remark, but I am speaking of the general principle. The lovely, the graceful, the elegant, the novel, the wonderful, the sublime—these are the food on which they banquet; the grandeur and magnificence of the heavens;—the terrible majesty of the tempestuous ocean—the romantic wildness of forests, and precipices, and mountains that lose themselves in the clouds—the sweet tranquillity of a summer evening—the rural gayety of vineyards, hop-grounds and cornfields—the cheerful hum of busy cities—the stillness of village solitude—the magic face of human beauty—the tear of distressed innocence—the noble struggle of worth with poverty, of patriotism with usurpation, of piety with persecution;—these, and innumerable images like these—tender, touching, dignified—are the subjects for which they fondly hunt, the themes on which they daily expatiate. To say nothing of the higher banqueting, "the food of angels," that religion sets before them.

It is true, that the mind thus constituted has its pains as well as its pleasures, nor are its pains few or of trifling magnitude. Wherever misery is to be found it seeks for it with restless assiduity, broods over it, and shares it; and where it is not to be found it fancies it. How often, waking to the roar of the midnight tempest, while dull and gluttonous indolence snores on in happy forgetfulness, does the imagination of those who are thus divinely gifted mount the dizzy chariot of the whirlwind, and picture evils that have no real existence; now, figuring to herself some neat and thrifty cottage where virtue delights to reside, she sees it swept away in a moment by the torrent, and despoiled of the little harvest just gathered in; now, following the lone traveller in some narrow and venturous pathway, over the edge of Alpine precipices, where a single slip is instant destruction, she tracks him alone by fitful flashes of lightning; and at length, struck by the flash, she beholds him tumbling headlong from rock to rock, to the bottom of the dread abyss, the victim of a double death. Or possibly, she takes her stand on the jutting foreland of some bold, terrific coast, and eyes the foundering vessel straight below; she mixes with the spent and despairing crew; she dives into the cabin, and singles out, perhaps, from the rest, some lovely maid, who, in all the bloom of recovered beauty, is voyaging back to her native land from the healing airs of a foreign climate, in thought just bounding over the scenes of her youth, or panting in the warm embraces of a father's arms:—

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* See Blair's Lectures, vol. iii. sect. xlvi.

She marks th' erected ear, the bloodless cheek,
  The rigid eye that never more shall weep:
She hears the horrors of the last loud shriek,
  And sees the vessel plunge beneath the deep.

Such are the painful pictures on which the keen soul of sensibility feeds too frequently in imagination, when the sigh of real misery is hushed, and its generous hand is not needed. But is there nothing to counterbalance the distress? To call forth the tear of joy, as well as of sorrow? And to reward the nice sympathy with which the mind labours? I pursued this pleasing train of contemplation, many years ago, in an elegy expressly directed to the present subject, from which, indeed, I have taken the lines just quoted; and as I do not know that I can answer this important question in prose better than in verse, I will beg leave to close the lecture, and with it the general task I have undertaken, with an additional extract. Having pointed out to those who are highly gifted with taste, genius, imagination, and fine feeling, the pains and anxieties which such a constitution of mind must necessarily give rise to, the poem proceeds as follows:—

Yet murmur not, nor deem the fates reserve
  No drop of solace mid the bitter stream;
Virtue is yours,—and still each trembling nerve
  Oft proves an avenue to bliss supreme.

Ye cannot wade through filth that dulness dares:
  Your nobler spirits soar above the clod:
Ye must be pure while yet your bosom bears
  The clear unsullied impress of your God.

Nor does the world, in every scene that springs,
  Nor Fancy's self, portray perpetual gloom.
Feel ye no joy when sickness smiles and sings?
  When worth succeeds? or culprits meet their doom?

Lo! where yon vale unfolds its pictur'd site,
  And meads and corn-fields mix their gay attire;
Sheep-cots and herds, and sprinkled cottage white,
  Stream, busy mill, deep wood, and tufted spire.

Can ermin'd guilt, when every scheme succeeds,
Feel half the joy that stirs your generous breast,
As, pleas'd ye ponder o'er these simple meads,
Compute their charms, and share their balmy rest?

And mark, untouch'd by city broils, the reign
Of rural comfort, cheerfulness and ease;
Of health, embloom'd from every sweet-briar lane,
And faith and morals wholesome as the breeze.

Go—climb yon castle cliff that meets the sky,
And tells of times tradition cannot reach;
And o'er the ruins, as ye throw your eye,
Of rocks and towers, with many a hoary breach,

Say—does the wreck of nature and of art,
The wild cascade, and echo undefin'd,
The grandeur, and the solitude impart
No pleasing train of image to the mind?

Or would ye change, for all that wealth can stake,
Ambition's plume, or lawless Pleasure's prime,
The feelings, then, that through the bosom wake,
And rouse the soul to ecstasies sublime?

Yet these—and countless sympathies like these,
Of purest zest, are yours, and yours alone:
Guilt knows them not, nor dull unwieldy Ease,
For Sensibility and Taste are one.

And well, thus gifted, may ye bear the thrill
Of social sorrows and ideal wrong;
Th' Eolian harp that heaven's pure breezes fill,
Must breathe at times, a melancholy song.

THE END.